EXAMINATION OF PROCESS IMPLEMENTATION OF EVIDENCE-BASED DESIGN INITIATIVES ON UNITED STATES ARMY MEDICAL CONSTRUCTION

A Thesis

by

GLENN EDWARD MARSH

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2010

Major Subject: Architecture

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Chair of Committee, Daniel K. Hamilton
Committee Members, Donald A. Sweeney
Roger S. Ulrich
Head of Department, Glen Mills

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ABSTRACT

Examination of Process Implementation of Evidence-based Design Initiatives on United States Army Medical Construction. (May 2010)

Glenn Edward Marsh, B.S., Texas A&M University

Chair of Advisory Committee: Prof. Daniel K. Hamilton

The objective of this research is to review the degree of United States Army compliance in the implementation of evidence-based design practices within the Military Health System construction cycle. This research looks at the impact of the 2007 Assistant Secretary of Defense for Health Affairs memorandum directing the use of evidence-based design within the Military Healthcare System construction process. The memorandum impacted the military medical construction process that includes over 6.2 billion dollars in government programmed military medical construction covering 9.2 million beneficiaries.

An analysis of federal construction documents, interviews, and an online survey was conducted with 85 government and civilian healthcare facility planners to measure general evidence-based design knowledge, direct knowledge of medical construction policy requirements, and the level to which the Military Health System Evidence-based Design Principles matrix has been implemented within four selected military medical construction projects.

Results of the review of construction publications show minimal evidence of evidence-based design incorporation with key federal regulatory documents. The results of an online survey conducted during the research had a 65.8% response rate (39 government personnel, 17 civilian personnel). The survey showed that basic knowledge of evidence-based design was present, but revealed severe deficiencies in specific knowledge and application of construction policies. Review of selected medical facilities demonstrated non-standardized incorporation of evidence-based design features. This research concludes that evidence-based design has achieved minimal integration into the Military Health System general knowledge base and project execution. Achieving compliance with the 2007 directive memorandum requires that significant efforts be made in personnel training and reconciliation with federal military medical construction documents.

DEDICATION

To our soldiers and families whose selfless actions defend our nation

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I would like to thank my committee chair, Assoc. Prof. D. Kirk Hamilton, and my committee members, Prof. Donald A. Sweeney and Prof. Roger S. Ulrich, and Prof. Mardelle Shepley and Assoc. Prof. Valerian Miranda for their invaluable advice, guidance, and support throughout the course of this research.

My thanks, also, to my friends, colleagues and the department faculty and staff for making my time back at Texas A&M University a richly rewarding experience.

I wish to extend my special gratitude to the government and civilian participants of my survey whose tireless efforts each and every day work toward a better tomorrow for all soldiers and their dependents.

Finally, thanks to my mother, father and my extended family for their unwavering love and support, and to my loving wife who makes all things worthwhile.

NOMENCLATURE

AT/FP	Anti-Terrorism and Force Protection
BIM	Building Information Modeling
COE	United States Army Corps of Engineers
DoD	Department of Defense
EDAC	Evidence-Based Design Accreditation and Certification
EBD	Evidence-Based Design
GSM	Net to Gross Square Meter
GUC	Guidance Unit Cost
IDS	Installation Design Standards
LEED	Leadership in Energy and Environmental Design
MHS	Military Health System
MILCON	Military Construction
NFPA	National Fire Protection Association
PMD	Project Management Division
PPD	Planning & Programming Division
ROI	Return On Investment
SEPSII	Space Equipment Planning System II
TMA	TRICARE Management Activity
UFC	Unified Facilities Criteria
USAHFPA	United States Army Health Facility Planning Agency

TABLE OF CONTENTS

Page

CHAPTER Page

LIST OF TABLES

Page

CHAPTER I

INTRODUCTION

In 2007, a series of intersecting events wove together to form a perfect storm of political controversy in Washington, D.C., over the state of the military healthcare system, resulting in a seemingly innocuous one-page memorandum issued by the then-Assistant Secretary of Defense for Health Affairs, Dr. William Winkenwerder. The memorandum simply instructed the Military Health System (MHS) construction authorities to apply patient-centered and evidence-based design principles across all medical military construction projects (Priest & Hull, 2007; Winkenwerder, 2007). Three years later, by 2010, this memorandum directing the incorporation of evidence-based design (hereafter referred to as EBD) has impacted over $6.2 billion dollars in government-programmed military medical construction, spanning 63 military hospitals and 800 primary medical and dental facilities, and has changed how United States military medicine supports its over 9.2 million beneficiaries (Casscells, Kurmel, Ponatoski, 2009). Through deft strokes of a signature pen, the force of history made itself known to the United States Army Military Health System.

This thesis follows the style of *Health Environments Research & Design Journal*.

The United States' experiences in pursuing the ongoing Global War on Terror along with numerous United Nations peacekeeping operations over the last few decades saw large numbers of soldiers involved in combat actions and non-battle injury scenarios. The constant armed forces mission tempo, coupled with a difficulty in attracting increasingly specialized medical personnel to the military, conspired with the compounding logistical and organizational restructuring issues required by the 2005 Base Realignment and Closure (BRAC 05) to slowly degrade the quality of medical care within the military health system. While the advanced medicine practices of the military health system were phenomenally effective in saving over 90% of those wounded in action (Gawande, 2004), the February 2007 *Washington Post* serial about Walter Reed Army Medical Center very publically demonstrated that the Department of Defense needed to modernize its medical facility structures and look to improve its healthcare system to meet the needs of soldiers, dependents, and medical staff (Priest & Hull, 2007). Understanding that it is strategically unsound and morally unethical not to provide the best possible care for soldiers and their dependents, the MHS turned tragedy into actions designed to improve the MHS medical readiness position.

To comply with Department of Defense policy, the Military Health System Office of Transformation developed a checklist of evidence-based design principles, interventions, and outcomes to guide medical facility planners on projects when dealing with the minutia of day-to-day process implementation of evidence-based design (Malone, Mann-Dooks, Strauss, 2007). The Military Health System evidence-based

design team developed a hypothesis that asserts that “if evidence-based design principles and survey recommendations are incorporated into designs, it will lead to improved outcomes for patients, staff, and United States taxpayers” (Casscells, Kurmel, Ponatoski, 2009, p. 140). This hypothesis meshes well with the military tenet of “Always Improve Your Position,” a phrase that rings as true today when applied to modern healthcare practices as when it was first recognized by soldiers as an action necessary to survive on the field of battle. Understanding the essence of the phrase explains its importance: to improve a position is to improve the odds of survivability and the chances of successfully accomplishing the mission. In business terms, this is often referred to as process improvement, whereby a process owner continually identifies, analyzes, and implements informed decisions within an organization to meet specific goals and objectives (Wheatley, 2006). Prior to considering the impacts of evidence-based design on patient outcomes and taxpayer burdens, its must first be understood how far integration of an evidence-based design process has been incorporated into the construction practices of the military medical facility planners of the United States Army.

This research investigation was conducted on the United States Army medical facility construction process to see exactly how far evidence-based design processes have been incorporated into construction practices. While documents reviewed in the course of this investigation examined the need for the military’s adoption of evidence-based design processes (Malone, Mann-Dooks, Strauss, 2007; Center for Health Design, 2009a) and looked at case examples that studied the effects of incorporation of evidence-

based design into currently ongoing medical construction projects (Kizer, McGowan, Boman, 2009), no publications to date show the extent to which evidence-based design principles have actually been incorporated into government construction practices. For military medical construction practitioners to have complied with the guidelines set forth by the Winkenwerder directive, integration of fully inclusive evidence-based design principles should be found in detail within the regulatory documents guiding United States Army (and federal) construction criteria, as measurable evidence of general evidence-based design knowledge among both government and non-government facility planners involved in the construction cycle, and as directly measurable evidence-based design features integrated into Army medical projects.

Knowing how evidence-based design principles have been incorporated to date within the military medical facility construction cycle presents opportunities for government personnel to provide corrections where needed to regulatory publications guiding construction and oversight practices in an effort to avoid the mishandling of taxpayer funding and the possible marginalization of expected evidence-based design benefits to the affected population.

CHAPTER II

LITERATURE REVIEW

To understand the basis for the Department of Defense decision to implement evidence-based design principles into the acquisition, design, and construction process, a review of relevant publications used by military healthcare construction agencies was conducted. The review focused on documents that provide design and construction guidance and documents used to provide evidence-based design training to government personnel. The Department of Defense uses these documents when initiating requests for proposals from civilian healthcare architecture and construction firms and to design contract documents prescribing requirements for the application of evidence-based design principles and the expected end results of evidence-based design. The review also examined evidence-based design information resources used to create buy-in of principles among policymaking leadership and the at-large healthcare culture (designers, healthcare staff, and patients).

The first documents reviewed were those that determine exactly how evidence-based design is defined by federal facility planners for government design review and legal contract definition for civilian architects and construction firms. Evidence-based design is explained as being directly related to the science of practicing medicine, a concept of modern science-based medicine created through the application of meticulous research. This relatively modern term for employing rigorous scientific methods to make

medical decisions for patient treatment has been named evidence-based medicine, or EBM (Sackett et al., 1996, Elstein, 2004). While evidence-based medicine concerns itself primarily with the microbiological aspects of patient treatment, the idea that patient health can be improved by the built environment is a concept that has been slow to catch on. Applied to medical construction, EBM forms the basis for the idea of evidence-based design, in that the health of patients, families, and staff are impacted by the building environment wherein healthcare treatment takes place. An improvement in patient clinical outcomes therefore must consider the building's design and construction in such a way that the building itself provides improvements to patient health by design.

This concept of building design playing a role in the health of patients was explored by Roger Ulrich in his pioneering 1984 study that found that surgery patients with a view of nature suffered fewer complications, used less pain medication, and were released from care sooner than those with a brick-wall view (Ulrich, 1979, 1984). Additional studies demonstrated that stress recovery of patients may be enhanced by access to nature and light (Ulrich, Simons, Barbara, et al, 1991). The Center for Health Design conducted a meta-analysis of available medical literature related to patient outcomes versus building environment in 1998, 2004, and 2008 that focused on the psychological and physiological effects of lighting, carpeting, and noise on healthcare patients and staff as measured through safety, wellness (physiological and psychological), and satisfaction levels (Rubin, Owens, Golden, 1998; Ulrich, Zimring, Quan, & Joseph, 2004; Ulrich, Zimring, Zhu, et al, 2008).

The idea that the built environment impacts its occupants led Kirk Hamilton in 2003 to consider trying to define the process of achieving specific outcomes through the use of applied research to the design and construction cycle (Hamilton, 2003). Hamilton's 2003 article "The Four Levels of Evidence-Based Practice" suggests that "Evidence-based healthcare designs are used to create environments that are therapeutic, supportive of family involvement, efficient for staff performance, and restorative for workers under stress" (p. 18). This initial evidence-based design definition has since been further refined by Hamilton: "Evidence Based Design is a process for the conscientious, explicit, and judicious use of current best evidence from research and practice in making critical decisions, together with an informed client, about the design of each individual and unique project" (Stichler & Hamilton, 2008, p. 3–4). Hamilton makes it clear that evidence-based design is neither a recipe nor a "cookie-book" approach (Hamilton, 2003, p. 18); a design team should use EBD principles to guide innovative solutions to healthcare problems.

The Center for Health Design, the organization founded in 1993 that administers the evidence-based design accreditation and certification (EDAC), built off Hamilton's work to define evidence-based design as the "process of basing decisions about the built environment on credible research to achieve the best possible outcomes" (Center for Health Design, 2008, p. 4).

At face value, this definition seems no different than the normal design process; the concept that a structure's design can have a positive impact on patient health is not new to the field of medicine. Antiquity is replete with examples of how infrastructure has been used to help the wounded and ill recover their health. Early historical examples can be found in such places as the ancient Greek healing temples dedicated to the healer-god Asclepius (D'Aulaire & D'Aulaire, 1962), where the ill sought healing in dreams. India's King Ashoka, who in 230 B.C. founded eighteen medical facilities, staffed both physicians and nurses at the nation's expense to care for his people (Finger, 2001).

Where evidence-based design methods differ is in the idea of conducting deliberate research throughout the facility cycle to inform future design decisions that contribute to measurable outcomes. Here, too, can be found historical precedents, perhaps the most famous being the imminently practical design changes instituted by Florence Nightingale in her statistically based work to change British field hospitals' operation and configuration during the 1853 Crimean War (Rehmeyer, 2009), which resulted in the drop of soldier deaths from disease from 42% to 3%. Of specific note is the long-term impact Nightingale's work had on the British health system; its ripples are still felt in today's modern healthcare setting far outside the boundaries of its British origin.

Nightingale's example is especially relevant to medical construction of today. It serves as a warning to designers, for while novel innovations are born due to necessity to

solve problems, institutional systems are notorious for slow adoption of new methods without rigorous proof and reassurance in predictable outcomes (Wheatley, 2006). Policymakers and healthcare planners must beware that once a system is changed, it is not easy to change again—this underscores the fact that research-based decisions must be rigorous in their undertaking, as mistakes, once implemented as construction, may become an unintentional part of the institutional system.

To understand the potential impacts through implementation of evidence-based design within military medical construction and to help guide federal facility planners, the United States Army Health Facility Planning Agency (USAHFPA), funded by the TRICARE Management Activity Portfolio Planning and Management Directorate, contracted with Noblis (formerly Mitretek Systems) to conduct a research study as the basis for educating military healthcare planners. The August 2007 "Evidence-Based Design: Application in the MHS" summarized for military healthcare planners the reasons for implementing EBD, available resources, and the then-current impacts of EBD within the medical construction community as centered around the Department of Defense EBD principles and goals (Malone, Mann-Dooks, Strauss, 2007). This report was crucial in the development of Military Health System Evidence-Based Design (MHS EBD) Team Principles, Interventions, and Outcomes Matrix, designed to guide military facility planners in the positive application of evidence-based design features. This matrix is reprinted for civilian use in the Center for Health Design's EDAC *Study Guide Number One: An Introduction to Evidence-Based Design* (Center for Health

Design, 2008). The matrix was used by the MHS EBD team to list the measurable design interventions that support their hypothesis that applied EBD principles positively impact patient outcomes and reduce taxpayer costs (Casscells, Kurmel, Ponatoski, 2009).

The EBD principles matrix provides facility planners with basic evaluation guides with which they compare pre-EBD and post-EBD medical facility designs. The 2007 “Evidence-Based Design: Application in the MHS” contributed to the development of the April 2008 TRICARE Management Activity (TMA) Healthcare Facility Evidence-Based Design Survey (May, 2008), which noted four major areas of beneficiary concern after surveying 382 active-duty personnel and 36 active-duty spouses: providing space for families, allowing patient control of environment (light, temperature, sound), enhancing room communications (such as Internet/e-mail access), and controlling privacy in rooms. These documents, along with the efforts of the 2001 Epidaurus Project led by Navy Captain Fred Foote and reports from the 2006 Quadrennial Defense Review 8, laid out the road ahead for the Department of Defense in implementing evidence-based design principles (Foote, 2001; Military Health System, 2006). As of this publication, formal training within Department of Defense construction offices has not been implemented beyond reviews of available military and civilian education documents and conferences (American Society for Healthcare Engineering, 2008; Center for Health Design, 2008; Center for Health Design, 2009a, 2009b).

A review of federal regulatory documents was also conducted to see what evidence-based design principles have been incorporated into the Military Health System since evidence-based design implementation was mandated in the 2007 Winkenwerder memorandum.

Army Regulation 415-15 Army Military Construction and Nonappropriated-Funded Construction Program Development and Execution (Department of Defense, 2006c), last updated in July 2006, outlines the authority and responsibility for planning, programming, and budgeting for United States Army medical military construction (MILCON) within the office of the Army's Surgeon General in coordination with the Assistant Secretary for Defense Health Affairs, the Defense Medical Facilities Office, and the TRICARE Management Activity Since the 2006 update, this construction authorization document has not been reconciled with the 2007 Winkenwerder memorandum or emerging evidence-based design initiatives.

One of several federal documents that facility planners look at to find regulatory guidance for incorporating evidence-based design interventions is the *Department of Defense Space Planning Criteria for Health Facilities* (Department of Defense, 2006a). This document contains most recommendations made in the 2006 *American Institute of Architects Guidelines for Design and Construction of Health Care Facilities,* but just as with the *Hospital of the Future* report from the Joint Commission, it fails to provide guidance on evidence-based design implementation other than to mention the process

(The Joint Commission, 2008). These documents include such evidence-based design features as the preference for single bedrooms as the minimum standard for medical/surgical and postpartum nursing units in general hospitals and revised bed clearances with bedside documentation areas in critical-care-unit single-patient room design. Both documents recommend the inclusion of hand-washing sinks, though neither specifies their location (American Institute of Architects, 2006). Of note, the *Department of Defense Space Planning Criteria for Health Facilities* has not been updated since February 2006.

The review of the *Space Equipment Planning System II* (SEPS II), used by Department of Defense facility planners for design layout and instruction to contractors, and the *Department of Defense Medical Equipment Room Guide Plates* was also found to include many of the recommendations from the 2006 *American Institute of Architects Guidelines for Design and Construction of Health Care Facilities*. Neither the guide plates nor SEPS II has been updated since 2006, and both exclude most evidence-based design criteria. Of specific note, neither document includes provisions for the discontinued use of multiple-patient rooms (Department of Defense, 2006b; McDermott, B., personal communication, February 1, 2010).

A critical document used by federal medical facility planners to instruct contracted architects and construction contractors is the 2009 edition of the *UFC 4-510-01 Unified Facilities Criteria (UFC) DoD Design: Medical Military Facilities* (formerly

published as *Military Handbook 1191 Department of Defense Medical and Dental Facilities Design and Construction Criteria*), which provides the first true direction of evidence-based design intervention by the Department of Defense. This document contains a summary of the directive from the 2007 Winkenwerder memorandum, a short explanation of what evidence-based design is (goals focus on promoting integrity of the clinical encounter, empowering the patient, relief of suffering, and promoting long-term health and wellness), and a short notation explaining the incorporation scope adjustments for Leadership in Energy and Environment (LEED) and evidence-based design net to gross square meter (GSM) calculations workup (Department of Defense, 2009b). *UFC 4-510-01* contains no guidance for the incorporation of evidence-based design into LEED or building information modeling (BIM) systems. For MILCON projects, the procedures outlined in this UFC apply from the time the design authorization (DA) is issued by the Portfolio Planning and Management Division (PPMD) and throughout the design, construction, beneficial occupancy, and the post-occupancy evaluation (POE) period. Other than the aforementioned material referencing evidence-based design, this document contains no further instruction on EBD principle implementation or evaluation but does include instructions for additions/changes to the documents through criteria change requests (CCR). *UFC 4-510-01* does not contain citations or references to support or provide further direction to facility planners on evidence-based design criteria (Department of Defense, 2009b).

Two publications by the US Army Health Facility Planning Agency, the *Environment of Care – US 2007* and the *Design & Implementation Guide 2007,* do offer facility planners some direction in implementing evidence-based design criteria (United States Army Health Facility Planning Agency, 2007a, 2007b). The documents provide philosophy guidance in the furniture and furnishings selections to enhance the healing environment by providing fabrics, upholsteries, and finishes that are anti-microbial and do not support mold or mildew growth. There are further suggestions on the arrangement of furniture in waiting spaces and family areas to promote conversation and interaction, as well as the reduction of spatial disorientation through wayfinding cues such as nature oriented positive distractions (photographic artwork) and the inclusion of audio nature sounds. Other suggestions include selecting finishes that enhance the healing environment by reducing the risk of falls, reducing noise through improvements in acoustics in the healthcare environment, and providing bright lighting (either natural or artificial) to help reduce depression. These recommendations are within the scope and spirit of the MHS EBD Principles, Interventions, and Outcomes Matrix but fail to provide specific application instructions or references to validated citations for planners to use to make decisions.

The Department of Defense uses the National Fire Protection Association (NFPA) specification codes outlined within *NFPA 99: Standard for Health Care Facilities, NFPA 101®: Life Safety Code®,* and *NFPA 101A: Guide on Alternative Approaches to Life Safety* to ensure construction safety within its healthcare facilities.

The current edition of *NFPA 99* (2005 edition) has not been reconciled with evidence-based design healthcare principles nor does it acknowledge potential conflicts that might arise between the design interventions. This same assessment holds true for both the *NFPA 101* (2009) and *NFPA 101A* (2010) documents. While each document contains individual specifications that might be interpreted as complementary to evidence-based design, none of the documents contains direct references for incorporation of evidence-based design criteria with NFPA codes (National Fire Protection Association, 2005, 2009, 2010).

Department of Defense medical planners also must consider regulatory guidance due to the adoption of the LEED program, and they must determine how those guidelines will interact or contradict evidence-based design considerations. As of the time of this study, federal documentation does note the necessity of both LEED and EBD features but does not provide definitive guidance on how they will be implemented together in a complementary fashion (FacilitiesNet, 2006; Department of Defense, 2009b). Of additional concern for facility planners are the requirements of federal buildings to conform to the antiterrorism construction regulations found in *UFC 4-010-01 Unified Facilities Criteria (UFC) DoD Minimum Antiterrorism Standards for Buildings* and *UFC 4-023-03 Unified Facilities Criteria (UFC) Design of Buildings to Resist Progressive Collapse.* The 2007 update to *UFC 4-010-01* does not address evidence-based design needs in any context, nor does the 2009 edition of *UFC 4-023-03*. These omissions of evidence-based design have serious implications for architects and

planners wishing to provide enhanced natural lighting and ease of wayfinding when compared to the need to design their buildings with blast-resistant curtain walls and structural resistances against progressive collapse (Department of Defense, 2007; Department of Defense, 2009c).

A review of industry and Department of Defense cost guidance further illustrates the challenge of evidence-based design integration compared to the rising cost of construction. Plainly stated, the cost of healthcare construction continues to rise at a rate disproportionate to the available medical construction funds (American Medical News, 2006; Mowad, 2007; National Coalition on Healthcare, 2009). How much more military medical construction should cost compared to the national average is a matter of contention. In 2007 the TRICARE Management Activity (the federal agency that manages Department of Defense medical construction) directed the use of an evidence-based design funding line in federal acquisition documents equaling 3–5% of a hospital facility's estimated project budget added to the total cost of the project. This surcharge was based on the qualitative rather than quantitative experience of TRICARE Management Activity due to a lack of available project cost history. Evidence-based design is therefore treated by the TRICARE Management Activity as a cost premium, rather than being incorporated in the project scope. As of 2009, the current guidance set forth in the *TMA Defense Department 1391 Cost Estimating Guidance for Medical Projects* remains the same as in 2007.

This evidence-based design cost guidance is also reproduced in the *US Army Corps of Engineers Instructions for Parametric Design Code 3* (Clark, 2010; United States Army Corps of Engineers, 2008). The accuracy of this additional cost factor remains indeterminate. Government facility planners can implement evidence-based design through interventions that are of near-equal cost of pre-evidence-based design facilities (Center for Health Design, 2008; Center for Health Design, 2009a).

The current TRICARE cost instruction does not cite or demonstrate acknowledgment of civilian studies, such as *The Evidence-Based Design Literature Review and Its Potential Implications for Capital Budgeting of Healthcare Facilities*, a study conducted by the University of California, Department of Civil and Environmental Engineering (Ballard, Rybkowski, 2007). The Department of Defense does recognize that new infrastructure must make the most of every available opportunity or else suffer potential marginalization effects for years to come. It should be noted that while military medical facilities may have some requirements unique to government that may drive up costs as compared to civilian facilities, such government construction surcharge factors have not been found within available literature to provide baseline comparisons (Department of Defense, 2007).

The May 2009 report by the National Capital Region Base Realignment and Closure Health Systems Advisory Subcommittee of the Defense Health Board for Achieving World Class Healthcare, entitled *An Independent Review of the Design Plans*

for the Walter Reed National Military Medical Center and the Fort Belvoir Community Hospital (Kizer, McGowan, Boman, 2009), compiles findings and recommendations for implementation of evidence-based design principles within federal Pebble Projects. The United States congressional mandate under the National Defense Authorization Act for Fiscal Year 2009 (NDAA 2009 Public Law 110-417) requires the construction of world-class medical facilities without providing the operational or functional details about the meaning of the term *world-class medical facilities*.

To date, no recognized body has established an operational definition of world-class medical facility, so the Health Systems Advisory Subcommittee created a definition to provide a metric. This is examined further in the analysis portion of this paper. The subcommittee specifically found that the creation of a world-class medical facility must begin with a clear vision and that "there is no evidence of a concerted, organized effort to engineer the new integrated military healthcare culture needed to achieve and sustain a joint Armed Services system that provides world-class medical care" (Kizer, McGowan, Boman, 2009, p. ES-1).

While analyzing construction of the new Fort Belvoir Community Hospital (FBCH), the subcommittee found that while there were many evidence-based design features incorporated into the project, there was no plan in place to evaluate the impact of incorporating evidence-based design features into the facility's layout (Kizer, McGowan, Boman, 2009). The subcommittee felt that such an assessment would be

valuable for informing plans for future federal hospital construction and therefore recommended that a plan to assess the outcomes, benefits, and return on investment of the design processes used for the new FBCH, as well as the benefits of incorporating EBD principles in such facilities, be developed, funded, and implemented. This course of action provides a strong case for future development of procedures to capture lessons learned from EBD projects and provide structured baseline metrics for evaluation of medical military EBD projects.

The federal publications reviewed in this study represent the most commonly referenced documents used to procure, design, and construct military medical facilities for the United States Army. Table 1 provides a graphical summary of construction documents that respondents of the Evidence-Based Design Understanding & Implementation within US Army Medical Construction survey conducted by this study should be familiar with when practicing the medical MILCON process for the United States government. Table 1 cells that contain a circular black mark indicate that the construction document listed on the far left hand side of the table is extensively referenced during the indicated facility lifecycle management phase. Cells without black mark may also reference listed documents, but are not a primary reference. Note that while the documents listed in Table 1 form the core of federal contracting requirements for the United States Army medical construction, this list may be amended by additional documents per a project's special construction requirement (such as special bio-Safety lab requirements).

Table 1. Summary Of Documents Reviewed For EBD Process Implementation Analysis

Reviewed Document	Reconciles With EBD Practices?	Military Medical MILCON Facility Life Cylce Management Process							Sustainment	Transition Planning
		Strategic Planning	Business Planning	Project Planning (New or Renovation)	Programming	Design	Construction	Commisioning		
2007 Winkenwerder memorandum	YES	●	●	●	●	●				
Evidence-Based Design: Application in the MHS Report	YES	●	●	●	●	●	●	●	●	●
Military Health System Evidence-Based Design (MHS EBD) Team Principles, Interventions, and Outcomes Matrix	YES			●	●	●	●	●	●	●
April 2008 TRICARE Management Activity (TMA) Healthcare Facility Evidence-Based Design Survey	YES		●		●	●	●	●		
Quadrennial Defense Review 8	YES	●	●	●						
An Independent Review of the Design Plans for the Walter Reed National Military Medical Center and the Fort Belvoir Community Hospital	YES	●	●	●	●	●				
The Evidence-Based Design Literature Review and Its Potential Implications for Capital Budgeting of Healthcare Facilities	YES	●	●			●				
Army Regulation 415-15 Army Military Construction and Nonappropriated-Funded Construction Program Development and Execution	NO	●	●	●				●		
Department of Defense Space Planning Criteria for Health Facilities	PARTIAL				●	●	●	●		
2006 American Institute of Architects Guidelines for Design and Construction of Health Care Facilities	PARTIAL	●	●	●	●	●	●	●	●	
Space Equipment Planning System II (SEPS II)	NO				●	●				
Department of Defense Medical Equipment Room Guide Plates	NO				●	●				
UFC 4-510-01 Unified Facilities Criteria (UFC) DoD Design: Medical Military Facilities	PARTIAL	●	●	●	●	●	●	●	●	●
Military Handbook 1191 Department of Defense Medical and Dental Facilities Design and Construction Criteria	NO	●	●	●	●	●	●	●	●	●
Environment of Care – US 2007	PARTIAL				●	●	●	●		
Design & Implementation Guide 2007	PARTIAL				●	●	●	●		
NFPA 99: Standard for Health Care Facilities	PARTIAL				●	●	●	●	●	
NFPA 101®: Life Safety Code	PARTIAL				●	●	●	●	●	
NFPA 101A: Guide on Alternative Approaches to Life Safety	PARTIAL				●	●	●	●	●	
Federal LEED program	NO		●	●	●	●	●	●	●	
UFC 4-010-01 Unified Facilities Criteria (UFC) DoD Minimum Antiterrorism Standards for Buildings	NO	●		●		●	●	●	●	
UFC 4-023-03 Unified Facilities Criteria (UFC) Design of Buildings to Resist Progressive Collapse	NO	●		●		●	●	●	●	
TMA Defense Department 1391 Cost Estimating Guidance for Medical Projects	YES		●	●	●	●				
US Army Corps of Engineers Instructions for Parametric Design Code 3	PARTIAL		●	●	●	●				

CHAPTER III

METHODS

This chapter discusses the research approach, the data gathering methods, and the originality and validity of the research data used in the study.

Research Approach

To measure the extent that military facility planners have implemented evidence-based design principles within military medical construction practices, a mixed method of qualitative and quantitative approaches was chosen. Using publically available publications in the literature to set a baseline of implemented EBD policy, interviews and an online survey were conducted, after institutional review board approval was obtained, to measure the current state of participants' overall knowledge of evidence-based design and construction policy requirements and to record their expert views on how well EBD principles have been implemented on four select military medical construction projects. Additionally, an analysis of the four select military medical construction projects was conducted using the Military Health System's evidence-based design principles matrix, which is the closest government and civilian validated metric base for an evidence-based design features comparison (Malone, Mann-Dooks, Strauss, 2007; Center for Health Design, 2008; Casscells, Kurmel, Ponatoski, 2009).

Originality of Survey Data

All data used for this research came solely from answers provided by available government publications, participants' survey responses, and individual interviews. No government or civilian publications that are similar to the research conducted were found.

Selection of Survey and Interview Participants

Due to the focused nature of this research on military medical construction, survey participants were not randomly selected. Participants asked to complete the online survey and interviews were directly selected based on their relevant military construction background. Participants included policy- and decision- making personnel, facility planners/designers, architects, construction managers, project officers, transition planners, equipment outfitters, and healthcare consultants/researchers. All participants had active experience in military medical facility planning and construction. Each individual was chosen because of his or her expertise and placement within the Department of Defense federal military medical facility acquisition and construction bureaucracy (with a particular focus on personnel from the TRICARE Management Activity and the US Army Health Facility Planning Agency) or due to his or her direct experience working on the selected military medical projects included in the study. Due to prohibitive travel distances between participants and project locations, an online survey and electronic mail correspondence were determined to be the tools that would provide the best level of response from participants (Groat & Wang, 2002).

Survey Method

As a method of determining the culture involved in policy decisions and implementation (Wheatley, 2006), each participant was asked to answer an identical Internet survey consisting of 30 multiple-choice questions (see Appendix C). The survey was sent by electronic mail to 85 active-duty military personnel, government schedule (GS) employees, civilian military contractors, and architecture/construction firm members with a known history of military medical projects.

The survey was designed to determine the level of experience of the participants, their knowledge of publication directives, their knowledge of evidence-based design procedures, and their familiarization with selected pre/post evidence-base-designed military medical facilities. The survey was conducted using the third-party collection services of Survey Monkey (http://www.surveymonkey.com), through a unique Web link sent via a blind copy format. No participant identification information was made available to individual participants or researchers, with Survey Monkey recording only Internet service provider (ISP) addresses. The anonymity provided to participants was designed to encourage open and honest answers. Additionally, each participant could only respond once through his or her provided unique Web link, and only on a single computer, to minimize any chance of multiple answers. Participants could choose to leave the survey at any time, though if they did so, they could not return to complete any unanswered questions (this action prevents a survey participant from providing multiple answers to questions).

Leadership Interviews

In addition, select individual government and civilian contract employees were interviewed on specific construction policies, regulations, and project experience to clarify design intents and decision backgrounds regarding those healthcare projects included within the study. Additional interviews were conducted with policymaking personnel to better understand the decisions made for implementing cost guidance criteria and guide plate publications, as noted within the literature review. Interviews with government and civilian leadership were conducted through both telephone and electronic mail. Telephone interviews and written interviews by traditional and electronic correspondence substantially reduced what would have been prohibitive travel costs for interviewing respondents, allowing for a much larger and varied response base.

Facility Analysis Method

Using the MHS EBD Principles, Interventions, and Outcomes Matrix as a government and civilian industry-acknowledged metrics benchmark (Center for Health Design, 2008; Center for Health Design, 2009a, 2009b; Casscells, Kurmel, Ponatoski, 2009), the Bassett Army Community Hospital, the 2007 Fort Belvoir Army Community Hospital, the new Walter Reed National Military Medical Center, and the new Fort Riley Army Community Hospital were analyzed to determine the extent to which EBD principle features were included in the final design/construction. The selected facilities ranged from being completed and operational (Bassett), to under construction (Belvoir and Walter Reed), to under design (Fort Riley).

Due to the limited number of available facilities utilizing evidence-based design concepts within the Department of Defense, these four facilities were determined as military medical examples of pre-EBD design and post-EBD design. This analysis encountered further data limitations due to the scarcity of information available to the public and from the incomplete nature of the Fort Belvoir, Walter Reed, and Fort Riley hospital projects at the time of this study. Additionally, a full top-to-bottom cost estimate analysis for these projects was not available from government publications and was deemed outside the scope of this research. Despite the limited analysis of these facilities, this analysis remains important to the study of EBD implementation given that the Fort Belvoir Community Hospital project has been discussed by the TRICARE Management Activity as a possible site-adaptable design due to its incorporation of evidence-based design features, despite not being validated by supporting research (Birdseye, T., and Lieutenant Colonel Hower, T., personal communication, August 2009).

CHAPTER IV

FINDINGS

The Survey of Evidence-based Design Understanding & Implementation within US Army Medical Construction (see Appendix C) conducted through the third-party Survey Monkey collection service (https://www.surveymonkey.com) was sent by electronic mail Web link to 85 active government and non-government civilian military contractors with direct experience in policy, design, and construction of military healthcare projects to rate their knowledge of official federal guidance, general evidence-based design knowledge, and current Department of Defense evidence-based design projects. Fifty-six of the 85 individuals who were sent surveys participated, for a 65.8% response rate. Seven individuals skipped one or more questions when answering the section on selected military medical facilities (87.5% of respondents completed all questions).

Evidence-based Design General Knowledge Findings

When asked about their highest level of familiarity with evidence-based design, 46.4% of those surveyed reported that they had attended conferences where evidence-based design application was discussed. A total of 10.7% of all respondents were EDAC certified (evidence-based design and accreditation certification), and 7.1% of all respondents had attended formal evidence-based design training. Additionally, 7.1% responded that while they knew of the evidence-based design process, they did not

practice an evidence-based design process. Zero respondents answered that they were unfamiliar with the concept of evidence-based design.

Of the government-employed respondents, 48.7% reported that they have attended lecture conferences where evidence-based design application was discussed. A total of 7.7% responded that they had either attended formal classes or had themselves participated in formal evidence-based design research, and 10.3% responded that they knew of the evidence-based design process but did not utilize evidence-based design criteria. Only one government employee (this researcher) responded as being EDAC certified. Of the non-government-employed respondents (civilian contractors), 41.2% reported that they had attended lecture conferences where evidence-based design application was discussed. While 29.4% responded that they were EDAC certified, only 5.9% responded that they had either attended formal classes or had participated in formal evidence-based design research. No non-government respondents replied that they knew of the evidence-based design but did not practice the EBD process.

When asked to rate their experience within the medical facility production and operation cycle, 62.5% of all respondents felt it was very important that policymakers be familiar with evidence-based design criteria. A total of 82.1% of all respondents felt it was very important that facility planners be familiar with evidence-based design criteria, and 55.4% felt it was very important that project/construction managers be familiar with evidence-based design criteria.

When surveyed on their knowledge of core documents guiding the implementation of evidence-based design principles within the Military Healthcare System, 55.4% of all respondents replied that they had read and understood Dr. Winkenwerder's 2007 Health Affairs memorandum (Winkenwerder, 2007) directing the incorporation of evidence-based design practices into new military medical facilities, while 41.1% responded that they had not read the directive. Of government personnel, 48.7% responded that they had read the memorandum, while 70.6% of non-government respondents reported having read the memorandum. When asked about having read and understood the 2007 report on evidence-based design in the Military Health System (Malone, Mann-Dooks, Strauss, 2007), 54.1% of government and 58.8% of non-government employees replied that they had not read the report. Additionally, 75.9% of government respondents replied that they had not read the results of the April 2008 TRICARE Survey (May, 2008) identifying what enhancements should be included in health facilities, as compared to 58.8% of non-government respondents who reported not having read the report.

Participants were surveyed on their opinions regarding the requirement of evidence-based design instruction before construction projects within the military medical construction system were awarded for contract. Eighty-eight percent of all respondents felt that evidence-based design instruction courses should be a requirement for military decision-makers/planners prior to awarding military medical facility projects. Fifty-four percent felt that architecture firm personnel should have some form of

evidence-based design certification (EDAC credentialed, research citations, etc.) as a requirement to bid on military medical facility projects. Fifty-six percent of respondents felt that construction firms bidding on military medical facility projects should similarly be evidence-based design certified prior to being awarded contracts by the government.

In addition, 48.5% of government survey participants reported that their organizations did not dedicate in-house resources to conducting research in accordance with the procedures outlined by the Center for Health Design, and 30.3% reporting that they did not know if their organization conducted evidence-based design research, despite the fact that the Center for Health Design publishes, in Appendix B of their study guide, the Military Health System's own evidence-based design interventions and outcomes matrix (Center for Health Design, 2008).

When asked about including specific evidence-based design criteria into government room guide plates and official prescriptive documents, 42.9% of all survey respondents felt that between four and six validated evidence-based design citations were necessary before inclusion. Another 38.7% of all respondents reported that they had personally studied four or more real-world evidence-based design projects to learn about the benefits/problems of evidence-based design features.

Military Healthcare Construction Evidence-based Design Cost Guidance

Survey participants were also asked if they had read the June 19, 2009, TRICARE Management Activity 1391 Cost Estimating Guidance for medical projects (also contained within US Army Corps of Engineers' *Instructions for Parametric Design [Code 3]*) that governs the estimating costs for implementing evidence-based design features into military medical facilities (Clark, 2010; United States Army Corps of Engineers, 2008). A total of 64.9% of government-employed respondents replied that they had not read the cost guidance, compared to 82.4% of non-government respondents who had not read the guidance. When specifically asked if they knew what the evidence-based design surcharge estimates were, 23.5% of all responders reported the correct answer of an additional 3–5% evidence-based design surcharge, while 40% believed that no additional costs should be added to the primary square foot cost of a facility (i.e., evidence-based design should not cost extra, as it should be included in "good design"). Telephone interviews with the TRICARE Management Activity found that the initial cost guidance issued in 2007 has not been updated due to a lack of historical data. David Clark, the issuer of the June 19, 2009, TRICARE Management Activity Department of Defense 1391 Cost-Estimating Guidance for Medical Projects, clarified this position:

> Some might say that good design is EBD and therefore is not a cost premium. I disagree with that because there are a number of building systems associated with EBD…Currently, EBD is a cost premium and therefore is NOT included in the GUC [guidance unit cost]. This will continue for a few years until the historical project costs include EBD. This is consistent with the way AT/FP

> [anti-terrorism/force protection] and information systems was once a premium and is now included in the GUC. (Clark, D., personal communication, January 12, 2010)

David Clark further elaborated that the current cost range is an estimate based on qualitative review of available government and civilian estimates rather than a quantitatively determined number. A full building cost analysis for evidence-based design features has not been considered in the current issue of federal cost guidance documents.

None of the reviewed federal documents concerning budgeting that are used to guide facility planners acknowledged evidence-based design return on investment (ROI) incentives or how to reconcile savings with split government funding lines (construction, operation, logistics, payroll, etc.).

Evidence-based Design Application Findings

Participants were asked survey questions to measure the importance of evidence-based design research goals and application of lessons learned within their organizations. Of the respondents, 58.8% replied that it is very important to establish clear research goals during the design phase, and 74.5% agreed that evidence-based design processes should be integrated into the pre-design phase of a medical project. Another 54.9% of respondents felt it was very important to establish evidence-based design metrics during

the design phase of a project, and 58.8% believed that post-occupancy evaluations should contain evidence-based design measures. Fifty-six percent of all respondents replied that in their organization, development and collection of realistic metrics are very important before construction begins. Eighty percent of all respondents reported that it is very important to their organization to apply lessons learned to their next project, while 48% replied that in actual practice, lessons learned/collected metrics are only occasionally applied to follow-up projects. Seventy-eight percent of all respondents felt that it was very important for leadership to be open to cultural transformation in regards to evidence-based design.

Survey participants were asked to rate the five categories of the MHS EBD Team Design Principles, Interventions, and Outcomes Matrix:

1. Creation of a family-centered environment.
2. Improvement of the quality and safety of healthcare delivery (reduce infections, high efficiency particulate absorbing [HEPA] filtration, reduce stress).
3. Enhancement of patient/family/staff contact with nature and positive distractions.
4. Creation of positive work environments through efficiencies, adjacency, lighting/sound/temperature control, and ergonomics.
5. Exhibition of standardization and flexibility in design.

When asked how important they felt the MHS EBD Team's five evidence-based categories of the EBD Principles, Interventions, and Outcomes Matrix were:

- 85.7% believed it was very important to improve the safety of healthcare delivery;
- 67.3% believed it was very important to create positive work environments through adjacencies, lighting/sound/temperature control, and ergonomics;
- 53.1% felt it was very important to create a family-centered environment;
- 51% felt it was very important that the design exhibit coherent standardization and flexibility; and
- 46.9% said it was very important to enhance patient/family/staff contact with nature and positive distractions, compared to 22.4% who felt that that it was only somewhat important.

These findings differ from the findings of the April 2008 TRICARE Management Activity telephone survey (May, 2008), where 79% of active-duty personnel and 83% of spouses desired room for families, compared to 53.1% of respondents from the online survey conducted in this study. However, 57% of active-duty personnel and 55% of spouses desired control of their environment (lighting/temperature/sound) in the TMA survey, which is comparable to the 67.3% who expressed a desire for environmental control in this study's survey.

Findings for Selected Military Healthcare Facilities

Participants were asked to analyze four military medical facilities using the Military Health System Evidence-based Design Principles, Interventions, and Outcomes Matrix (Casscells, Kurmel, Ponatoski, 2009). The facilities analyzed for evidence-based design features were the Bassett Army Community Hospital, the Fort Belvoir Army Community Hospital, the Walter Reed National Military Medical Center, and the new Fort Riley Army Community Hospital.

Bassett Army Community Hospital, located in Fort Wainwright, Alaska, was completed in 2007. As of March 2010, the Fort Belvoir Army Community Hospital, located in Alexandria, Virginia, is under construction with an expected beneficial occupancy date of September 2010. The Walter Reed National Military Medical Center, also currently under construction, is a renovation and new addition project replacing Bethesda Naval Hospital in Maryland. The new Fort Riley Army Community Hospital construction project was awarded for design in September 2009 and will be located in Fort Riley, Kansas.

Bassett Army Community Hospital Findings

Bassett Army Community Hospital opened in 2007 prior to the implementation of Dr. Winkenwerder's 2007 evidence-based design directive memo; however, Bassett was designed with many construction features that can be classified as evidence-based design interventions. Review of Bassett's construction documents (HKS Architects,

2000) and interviews with project officers, including a former chief of hospital logistics, showed that Bassett was designed around single-patient rooms (although not sized with "family zone" areas), with lighting, temperature, and limited sound control through patient-oriented "relaxation channels" (Lieutenant Colonel Williams, T., & Gerdes, D., personal communication, February 9, 2010). Bassett features an array of positive distractions that form distinctive wayfinding points for patients and families. The addition of binaural lighting in high-traffic areas of the hospital was designed to combat the long, dark hours of the Alaska winters by aiding circadian rhythms through timed illumination cycles. When comparing Bassett to the Military Health System Evidence-based Design Principles, Interventions, and Outcomes Matrix, the Bassett Army Community Hospital either meets or partially achieves all stated intervention categories.

Survey participants were asked to rate Bassett Army Community Hospital, for each of the evidence-based design matrix goals, according to whether the facility failed to achieve a category goal, partially achieved a category goal, or achieved a category goal. Participants also had the option to indicate that they did not know the answer. Again, the five matrix categories used for rating include the following:

1. Creation of a family-centered environment.
2. Improvement of the quality and safety of healthcare delivery (reduce infections, HEPA filtration, reduce stress).
3. Enhancement of patient/family/staff contact with nature and positive distractions.

4. Creation of positive work environments through efficiencies, adjacency, lighting/sound/temperature control, and ergonomics.
5. Exhibition of standardization and flexibility in design.

Of the government and non-government survey participants who analyzed the Bassett Army Community Hospital against the MHS EBD Team's matrix:

- 71.4% did not know if the new construction improved the safety of healthcare delivery;
- 69.4% did not know if the new construction design exhibited coherent standardization and flexibility;
- 63.7% did not know if the new construction created a family-centered environment;
- 63.3% did not know if the new construction created positive work environments through adjacencies, lighting/sound/temperature control, and ergonomics; and
- 61.2% did not know if the new construction enhanced patient/family/staff contact with nature and positive distractions.

Table 2 summarizes survey responses for Bassett Army Community Hospital where participants were asked to analyze the facility using the Military Health System evidence-based design matrix Principles, Interventions, and Outcomes Matrix.

Table 2. Bassett Army Community Hospital EBD Principles, Interventions, and Outcomes Matrix Survey Summary

EBD Principle	Did Not Achieve Goal	Partially Achieved Goal	Achieved Goal	I Do Not Know
1. Creation of a family centered environment.	0.0%	18.4%	14.3%	67.3%
2. Improvement of the quality and safety of healthcare delivery (reduce infections, HEPA filtration, reduce stress).	0.0%	10.2%	18.4%	71.4%
3. Enhancement of patient/family/staff contact with nature and positive distractions.	6.1%	10.2%	22.4%	61.2%
4. Creation of positive work environments through efficiencies, adjacency, lighting/sound/temperature control, and ergonomics.	2.0%	14.3%	20.4%	63.3%
5. Exhibition of standardization and flexibility in design.	4.1%	18.4%	8.2%	69.4%

Fort Belvoir Army Community Hospital Findings

Fort Belvoir Army Community Hospital is expected to become operational in September 2010. Findings during the review of the construction drawings revealed that the facility achieves or partially achieves the design goals of all five of the categories put forth by the Military Health System Evidence-based Design Principles, Interventions, and Outcomes Matrix (HDR Architects, 2009b). Survey findings indicate that 51% of participants felt that the goal of achieving a family-centered environment had been reached, while 40.8% did not know. In addition, 42.9% felt that the goal concerning the quality and safety of healthcare delivery had been achieved, while 46.9% of those

surveyed did not know. When considering the enhancement of patient/family/staff contact with nature, 53.1% felt the goal had been achieved, while 40.8% did not know. In the creation of positive work environments, 51% of participants felt the goal had been achieved, with 38.8% reporting that they did not know. Finally, when asked whether the facility design exhibited coherent standardization, 16.3% felt there was a partial goal achievement, 42.9% felt the goal had been achieved, and 38.8% reported they did not know.

Table 3 summarizes survey responses for Fort Belvoir Army Community Hospital where participants were asked to analyze the facility using the Military Health System evidence-based design matrix Principles, Interventions, and Outcomes Matrix.

Table 3. Fort Belvoir Army Community Hospital EBD Principles, Interventions, and Outcomes Matrix Survey Summary

EBD Principle	Did Not Achieve Goal	Partially Achieved Goal	Achieved Goal	I Do Not Know
1. Creation of a family centered environment.	0.0%	8.2%	51.0%	40.8%
2. Improvement of the quality and safety of healthcare delivery (reduce infections, HEPA filtration, reduce stress).	0.0%	10.2%	42.9%	46.9%
3. Enhancement of patient/family/staff contact with nature and positive distractions.	0.0%	6.1%	53.1%	40.8%
4. Creation of positive work environments through efficiencies, adjacency, lighting/sound/temperature control, and ergonomics.	0.0%	10.2%	51.0%	38.8%
5. Exhibition of standardization and flexibility in design.	2.0%	16.3%	42.9%	38.8%

Interviews conducted with the architecture firm (HDR) in September 2009 revealed that no single source of evidence-based design research was used to design interventions. When asked about the development of research hypotheses, HDR's representative answered that this action was not completed and was split among various workers (Dellinger, B., personal communication, September 29, 2009). No consolidated goals or metrics beyond an unspecified listing of those evidence-based design principles outlined within the 2007 report on evidence-based design in the Military Health System were cited as having been used in the facility design (Malone, Mann-Dooks, Strauss, 2007). HDR replied that they did not have copies of the April 2008 TRICARE

Management Survey on enhancements to health facilities or the June 2009 TRICARE Management Activity Department of Defense 1391 Cost Estimating Guidance for Medical Projects (Dellinger, B., personal communication, February 1, 2010). HDR provided file transfer protocol (FTP) access for viewing the Fort Belvoir Army Community Hospital construction documents; however, review of posted documents did not show evidence of evidence-based design research citations or planning metrics stored in HDR's common pool project files (HDR Architects, 2009a).

Interviews with the USAHFPA Fort Belvoir project officer revealed that while evidence-based design features were incorporated into the facility, support from oversight agencies such as the United States Army Corps of Engineers Center for Medical Excellence provided little assistance in assuring that the evidence-based design goals were achieved. The main concern from the Corps of Engineers concerned the additional costs associated with evidence-based design and the impact to the overall funding for the project (Fortune, D., personal communication, January 7, 2010). No evidence-based design research efforts were cited by the project officers or Corps of Engineers representatives, nor had representatives received direction to conduct such research.

The interview findings with the Fort Belvoir onsite project officer and HDR were mirrored in a 2009 independent review of the design plans for the Walter Reed National Military Medical Center and the Fort Belvoir Community Hospital conducted by the

National Capital Region Base Realignment and Closure Health Systems Advisory Subcommittee of the Defense Health Board. The subcommittee found the project to be well conceived in the inclusion of many important evidence-based design features but expressed the view that there was neither evidence of a plan to evaluate the facility nor evidence of a facility master plan. The subcommittee noted that such plans would be valuable for future hospital construction, especially in the incorporation of information technology for diagnostic and treatment technologies (Kizer, McGowan, Boman, 2009). This finding is especially relevant when viewed in light of interviews conducted with senior United States Army Health Facility Planning Agency decision-makers, who expressed concern that the TRICARE Management Activity began discussions on making the Fort Belvoir Army Community Hospital a site-adaptable design for future community hospital projects without first validating the facility under construction (Birdseye, T., Lieutenant Colonel Hower, T., personal communication, July 2009).

Walter Reed National Military Medical Center Findings

The Walter Reed National Military Medical Center is a large-scale renovation and expansion of the National Naval Medical Center in Bethesda, Maryland, as directed under the 2005 Base Realignment and Closure Report (Department of Defense, 2005).

Government and non-government survey participants were asked to analyze the design of the Walter Reed National Military Medical Center using the five evidence-

based design principles, interventions, and outcomes of the Military Health System design team matrix. Findings showed that:

- 75.5% did not know if the new construction created a family-centered environment.
- 75.5% did not know if the new construction improved the safety of healthcare delivery;
- 75.5% did not know if the new construction design exhibited coherent standardization and flexibility;
- 73.5% did not know if the new construction enhanced patient/family/staff contact with nature and positive distractions; and
- 73.5% did not know if the new construction created positive work environments through adjacencies, lighting/sound/temperature control, and ergonomics.

Table 4 summarizes survey responses for Walter Reed National Military Medical Center where participants were asked to analyze the facility using the Military Health System evidence-based design matrix Principles, Interventions, and Outcomes Matrix.

Table 4**.** Walter Reed National Military Medical Center EBD Principles, Interventions, and Outcomes Matrix Survey Summary

EBD Principle	Did Not Achieve Goal	Partially Achieved Goal	Achieved Goal	I Do Not Know
1. Creation of a family centered environment.	6.1%	14.3%	4.1%	75.5%
2. Improvement of the quality and safety of healthcare delivery (reduce infections, HEPA filtration, reduce stress).	0.0%	20.4%	4.1%	75.5%
3. Enhancement of patient/family/staff contact with nature and positive distractions.	10.2%	14.3%	2.0%	73.5%
4. Creation of positive work environments through efficiencies, adjacency, lighting/sound/temperature control, and ergonomics.	4.1%	18.4%	4.1%	73.5%
5. Exhibition of standardization and flexibility in design.	8.2%	14.3%	2.0%	75.5%

The primary findings of the 2009 independent review of the design plans for the Walter Reed National Military Medical Center and the Fort Belvoir Community Hospital (Kizer, McGowan, Boman, 2009) state that:

- To date, no recognized body has established an operational definition of world-class medical facility.
- The service-specific and facility-centric cultures of the Army, Navy and Air Force medical commands conflict with the needs of an IDS [installation design standards], and there is no evidence of a concerted, organized effort to engineer the new integrated military healthcare culture needed to achieve and

> sustain a joint Armed Services IDS that provides world-class medical care. (p. 5)

The 2009 review (Kizer, McGowan, Boman, 2009) also cited specific inclusion of evidence-based design as a feature in the definition of a world-class medical facility:

> A medical facility achieves the distinction of being considered world class by doing many things in an exceptional manner, including applying evidence-based healthcare principles and practices, along with the latest advances in the biomedical, informatics and engineering sciences; using the most appropriate state of-the-art technologies in an easily accessible and safe healing environment; providing services with adequate numbers of well-trained, competent and compassionate caregivers who are attuned to the patients' [needs], and his or her family's culture, life experience and needs; providing care in the most condition-appropriate setting with the aim of restoring patients to optimal health and functionality; and being led by skilled and pragmatic visionaries. The practices and processes of a world-class medical facility are models to emulate. (p. B-1)

When conducting the review, the subcommittee of the Defense Health Board found that the current design of the Walter Reed National Military Medical Center does not meet world-class healthcare standards. Additionally, the subcommittee reported that there is no comprehensive master plan for Walter Reed National Military Medical Center that includes the combined and augmented assets of Walter Reed Army Medical

Center and the National Naval Medical Center that integrates the Uniformed Services University for the Health Sciences (USUHS), the Joint Pathology Center (JPC), and other specialized centers or institutions on the facility grounds or in proximal location to Walter Reed National Military Medical Center main healthcare complex.

In addition, the subcommittee reported that it found little evidence for any clinicians' or other stakeholders' input in the final designs created by facility planners for Walter Reed National Military Medical Center. Specific deficiencies noted include the following: areas of the hospital are not in compliance with the Joint Commission's hospital design standards; the bed plan does not provide for broad conversion to single-patient rooms; significant surgical suite issues, patient transportation and wayfinding issues, and observational care design deficiencies exist; there is no inclusion of ancillary labs at offsite locations away from the primary facility; patient parking has limitations; and there are logistical concerns for expanded support services (Kizer, McGowan, Boman, 2009).

In defining the criteria for world-class healthcare, the subcommittee provided specific evidence-based design standards that must be met; however, the subcommittee did not include specifications or metrics to determine success of included evidence-based design features. This definition of world-class healthcare has not been adopted or incorporated into any of the current core federal construction criteria documents.

Findings for the Fort Riley Army Community Hospital

No submission construction documents were available from federal planners at the time of this publication, only concept designs. Review of preliminary designs from the architecture firm Leo A. Daly and RLF show design intentions for evidence-based design healthcare features and LEED Silver construction goals utilizing BIM and early contractor involvement methods for a fast-track construction delivery. Interviews with the USAHFPA's chief of the Planning & Programming Division (PPD) and chief of the Project Management Division (PMD) found that no resources had been allocated to conduct evidence-based design research by government personnel to establish hypotheses or measurable design goals for the Fort Riley Army Community Hospital project (Birdseye, T., Lieutenant Colonel Hower, T., personal communication, July 2009). Interviewed personnel expressed frustration with the lack of a cohesive approach to citing and validating interventions in the Department of Defense when applying evidence-based design features.

Government and non-government survey participants were asked to analyze the design of the Fort Riley Army Community Hospital using the five evidence-based design principles, interventions, and outcomes of the Military Health System design team matrix. Results showed that:

- 83.7% did not know if the new construction improved the safety of healthcare delivery;

- 77.6% did not know if the new construction created a family-centered environment;
- 77.6% did not know if the new construction enhanced patient/family/staff contact with nature and positive distractions;
- 79.6% did not know if the new construction created positive work environments through adjacencies, lighting/sound/temperature control, and ergonomics; and
- 77.6% did not know if the new construction design exhibited coherent standardization and flexibility.

Table 5 summarizes survey responses for Fort Riley Army Community Hospital where participants were asked to analyze the facility using the Military Health System evidence-based design matrix Principles, Interventions, and Outcomes Matrix.

Table 5. Fort Riley Army Community Hospital EBD Principles, Interventions, and Outcomes Matrix Survey Summary

EBD Principle	Did Not Achieve Goal	Partially Achieved Goal	Achieved Goal	I Do Not Know
1. Creation of a family centered environment.	0.0%	10.2%	12.2%	77.6%
2. Improvement of the quality and safety of healthcare delivery (reduce infections, HEPA filtration, reduce stress).	0.0%	8.2%	8.2%	83.7%
3. Enhancement of patient/family/staff contact with nature and positive distractions.	2.0%	6.1%	14.3%	77.6%
4. Creation of positive work environments through efficiencies, adjacency, lighting/sound/temperature control, and ergonomics.	0.0%	8.2%	12.2%	79.6%
5. Exhibition of standardization and flexibility in design.	0.0%	10.2%	12.2%	77.6%

CHAPTER V

CONCLUSIONS

Summary

Government and civilian military medical facility planners recognize that including evidence-based design features within military medical facilities is no longer an option but is a directive with the force of regulation and the attention of the United States Congress. The 2007 Dr. Winkenwerder memorandum and the dictates of congressional inquires noted within the National Capital Region military healthcare system have ended the conversation concerning whether or not evidence-based design is a fad or buzz word. What this leaves is the need for an assessment of the current state of evidence-based design principles' implementation within the military health facility construction cycle.

For this study, examinations of government construction regulations and government-sponsored evidence-based design resource reports, as well as interviews with senior military and civilian construction leadership, made it possible to analyze government evidence-based design policies as they currently stand. Billions of dollars worth of medical infrastructure and hundreds of thousands of government beneficiaries underscore the importance of correctly implementing evidence-based design practices within government construction projects. The future impact of health facility regulations on the civilian market that may be derived from the study of government projects makes

it all the more necessary to ensure that evidence-based practices are correctly understood and applied throughout the construction cycle.

Conclusions

Evidence from reviews of publications guiding government medical facility planners and contracted civilian organizations indicate that evidence-based design has at this time only been marginally implemented. This assessment is further supported by interviews with facility planners who express frustration and disagreement with current evidence-based design policies. Evidence-based design principles have made inroads into key federal construction documentation; however, the majority of such inclusions generally refer to the need for evidence-based design interventions rather than give substantial guidance on how to achieve or measure such inclusions.

A few documents, such as the 2009 edition of the *UFC 4-510-01 Unified Facilities Criteria* and the *Instructions for Parametric Design (Code 3)*, do include cost estimate provisions for assessing evidence-based design but have been found to be based primarily on qualitative assessments from civilian sources rather than on government actual full-building construction estimations. While this is understandable given the relatively few evidence-based design projects the government has conducted, there are still measures of disagreements with the surcharge cost estimates (Department of Defense, 2009b; United States Army Corps of Engineers, 2008). The confusion concerning what actual costs should be added for incorporation of evidence-based design

features was supported by survey respondents, of whom only 23.5% could correctly identify the current cost guidance, with an additional 40% replying that there should be no additions to the primary square meter cost. This confusion is further compounded by the incorporation of evidence-based design features within Bassett Army Community Hospital prior to the mandate to use evidence-based design and prior to the surcharge implementation (note, however, that Bassett suffered cost-creep due primarily to its wintery Alaskan location, which required costly site-related construction adaptations).

Additional key federal construction documents have not been updated to include evidence-based design information, or fail to reconcile how conflicts between regulatory guidance will be achieved (LEED & anti-terrorism/force protection are particular issues). These documents in turn inform the government Space Equipment Planning Systems II program and construction guide plates, which have themselves not been updated to include mandated evidence-based design features.

The overall exclusion of evidence-based design information from official documents suggests a critical lack of validated metrics by which government decision-makers can evaluate potential construction bids or by which completed designs may be evaluated for performance. At worst, this lack of validated metrics allows for organizations to claim evidence-based features without having to meet official standards (which do not seem to yet exist). The online research survey of government and civilian personnel involved in military medical construction revealed that 22.4% of all

respondents believed their organizations (including both civilian and military) use evidence-based design as a marketing tool rather than for applying interventions based on rigorous research. The key danger here lies not in potential fraud issues (the government has means in place to recoup such losses), but rather in the incorporation of non-validated interventions into government facilities that may in turn be further utilized as future references for construction standards. The use of non-validated referenced facilities may introduce systemic problems into the construction cycle (much as the discussion noted for using the new Fort Belvoir Army Community Hospital as a site-adaptable design without rigorous validation).

This trend concerning lack of data governing evidence-based design application is reinforced by the findings of the independent review of the design plans for the Walter Reed National Military Medical Center and the Fort Belvoir Community Hospital. The report highlights both the lack of application of evidence-based design features within the physical structure and the significant concerns due to the non-definition of terms and outcome expectations within all branches of the Department of Defense (Kizer, McGowan, Boman, 2009). Further, the Defense Health Program's 2010 budget estimates exclude mention of specific research monies set aside for the development of evidence-based design research, leaving such activities to the discretion of individual branches (Department of Defense, 2009a).

The lack of evidence-based design inclusion into official documentation is tied with the major deficiencies noted in the general knowledge base of surveyed respondents. Government personnel demonstrated evidence of being unaware of the majority of key evidence-based design directive documentation and guiding research reports regarding evidence-based design implementation within the Military Health System. Forty-one survey respondents replied that they had over 6 years of experience within the medical construction field, but only 25% of all respondents replied that they were EDAC certified or had participated in formal evidence-based design classes or research. While this may be partially explained by the relatively new acceptance of evidence-based design as a recognized industry practice, it underscores the fact that official directives have not caught up to evidence-based knowledge.

There were several positive evidence-based design trends on which survey respondents agreed. They agreed that it is very important to incorporate evidence-based design in the pre-design phase of projects, with clearly established goals and research methods. This aligned with significant agreement among respondents (88%) that government personnel should be required to take formal evidence-based design courses prior to awarding construction projects, and with a 56% agreement that construction bidders should be able to demonstrate evidence-based design certifications or citation material prior to award. These figures support the idea that to make evidence-based design viable, construction leadership must be open to cultural transformation (there was 78.4% agreement with this statement from all respondents). There is further positive

indication from respondents (80%) that they feel it is very important that their organizations apply lessons learned from past projects to future projects; however, only 48% replied that their organizations do occasionally apply such lessons learned. These results are particularly concerning and may be a factor contributing to the slow pace of incorporation of evidence-based design into official regulatory documents.

Analysis of the selected medical facilities, examined in the online survey and through construction documents, supports the overall findings noted in the congressional independent review of the design plans for the Walter Reed National Military Medical Center and the Fort Belvoir Community Hospital. The facilities show partial inclusion of evidence-based design features, but without guiding research-based hypotheses or integrated plans to collect metrics for analysis.

While the inclusions of evidence-based design features in the Fort Belvoir Army Community Hospital and the Walter Reed National Military Medical Center will provide researchers starting points for the development of data collections, the likelihood that these facilities will be studied for future projects by construction personnel is small. The majority of survey respondents did not know the status of any of the evidence-based design features included in any of the selected Army medical projects used in this study. This lack of knowledge calls into doubt whether facility planners are sufficiently prepared to apply any lessons learned from current projects to realize taxpayer savings or increase positive patient outcomes.

Recommendations for Further Study

This research has highlighted many of the current shortfalls examined in the implementation of evidence-based design into government healthcare construction practices. While these deficiencies are substantial, in most cases they provide great opportunities for continued study of evidence-based design that can contribute to both federal and civilian construction practices.

The Fort Belvoir Army Community Hospital and the Walter Reed National Military Medical Center report and the military construction guidance documents reviewed support the need for the development of definitions for the Department of Defense Military Health System. The congressional report specifically outlines ideas for a unified service branch definition of world-class healthcare, going so far as to establish a proposed definition that includes evidence-based design provisions. The need to firmly establish definitions as outlined in the congressional report, the directive from the Secretary of Defense for Health Affairs, and the supporting evidence shown in this research suggest that the TRICARE Management Activity may be best suited to define branch immaterial term definitions with support of the service branches (Army, Navy, and Air Force).

It is not an option to exclude evidence-based design requirements in military medical construction, so there is a direct need to develop the following within the United States Army medical construction cycle:

- A formal evidence-based design education requirement for facility planners.
- An accessible database of medical facility projects (pre and post evidence-based design) containing post-occupancy inspection results and realistic design metrics for evaluation.
- Research into actual design costs for evidence-based design features within military medical facilities.
- A Facility Research Division with the United States Army Health Facility Planning Agency to systemically collect and validate evidence-based design information.
- Updated military construction guidance documents with validated evidence-based design information in conjunction with the TRICARE Management Activity and United States Army Corps of Engineers.

Additional areas for future Department of Defense research efforts include the reconciliation of evidence-based design with anti-terrorism construction requirements and LEED.

Research on the US Army's return on investment for implementing evidence-based design must also be considered as a priority investigation. During the course of the preparation of the literature review for this study, no guidance was found in connection with recoup cost expenditures associated with evidence-based design interventions within military medical facilities. Considering the separation of funding lines within

government facilities (operation, construction, maintenance, logistics, payroll, etc.), which do not normally intersect, it is difficult to interpret how the US Army can expect to quantify any saving results other than operational/logistics savings due to shorter patient stays and reductions in costly medications from evidence-based design interventions. Additionally, savings occurring in government facilities are not directly translatable to reinvestment in infrastructure. Research is required into how to best realize return on investment cost savings associated with evidence-based design while acknowledging that such savings can be absorbed and redistributed by the aggregate federal budget rather than used directly to reduce taxpayer burdens.

Research Limitations

Between 2007 and the time of this publication, only three medical facilities (Fort Belvoir Army Community Hospital, Walter Reed National Medical Center, and the new Fort Riley Army Community Hospital) had been mandated to include evidence-based design features. The Fort Riley Army Community Hospital, in particular, was only recently awarded, leaving few construction documents for examination. This limited facility data pool hampered efforts to study in-depth physical examples of Department of Defense evidence-based design integration or to properly validate the GUC accuracy as stipulated by the TRICARE Management Activity. Additionally, the author, as a member of the United States Army Healthcare Planning Agency, may have introduced bias to interpretation of data results. Finally, utilization of an online survey using non-randomized participants to gather information on evidence-based design training and

knowledge may have been influenced by the uncontrolled nature of participants' response environments. Participants were selected from among TRICARE Management Activity personnel and, primarily, United States Army health facility personnel, so results obtained from the literature review and online survey are not applicable across the Department of Defense (it should be noted that almost all of the federal and civilian construction documents reviewed do apply to the entirety of the Department of Defense medical construction program).

Closing Thoughts

The United States Army has long followed the creed of *Mission First, People Always*. The decision to incorporate evidence-based design processes into the United States Army Medical MILCON program represents a positive evolutionary step within the military healthcare system to redefine people as the mission.

Is seems to be clear based on the results gathered from the review of federal construction documents, the survey responses from participants on evidence-based design, and the analysis of the selected medical facilities that incorporation of evidence-based design processes are in the infant stage within the United States Army medical construction program. While results obtained by this research could be interpreted in a negative manner, there are clear signs that evidence-based design has moved beyond a theoretical or philosophical state and into an active cycle of program improvement by both government and civilian business partnerships. While mandated directives may

drive the inclusion of evidence-based design in military medical facilities, it is up to government and civilian military medical facility planners to embrace opportunities for validating best practices used in project construction. Within an ever-tightening federal budget, every dollar spent on military medical construction must work to advance improvements in patient outcomes while providing healing environments for patient families and staff.

The intentional use of evidence-based design within military medical facilities to positively enhance the health, care, and welfare of patients, families, and staff has reinforced the United States Army medical construction program's move from an outdated institutionalized level of care to a modern healthcare facility system that is adaptable to future challenges and that places *People First—Always*.

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APPENDIX A

Memo from Dr. Winkenwerder

HEALTH AFFAIRS

THE ASSISTANT SECRETARY OF DEFENSE

1200 DEFENSE PENTAGON
WASHINGTON, DC 20301-1200

JAN 22 2007

MEMORANDUM FOR COMMANDER, NAVAL FACILITIES ENGINEERING COMMAND
COMMANDER, UNITED STATES ARMY CORPS OF ENGINEERS

SUBJECT: QDR Roadmap and Evidence-Based Design

As BRAC implementation drives the acquisition of new medical facilities in San Antonio and the National Capital Area, I request that you instruct the respective design teams to apply patient centered and evidence based design principles across all medical MICLON construction projects. A growing body of research has demonstrated that the built environment can positively influence health outcomes, patient safety, and long-term operating efficiencies to include reduction in staff injuries, reduction in nosocomial infection rates, patient falls, and reductions in length of hospital stay. Incorporating the results of this research along with changes in concepts of operations into the design of some of our most significant facilities will allow the Military Health System and the patients entrusted to our care to reap substantial health and system wide benefits for many years to come.

The Military Health System Office of Transformation was established by the Deputy Secretary of Defense to ensure that recommendations from the Quadrennial Defense Review are effectively implemented. QDR Roadmap 17 mandates leveraging and integrating evidence-based medicine with effective patient partnerships to ensure judicious use of resources while promoting healthy individuals and communities. In support of QDR Roadmap 17, the Office of Transformation has assumed leadership of a Tri-Service interdisciplinary team with substantial knowledge of patient centered and evidence based design. This team can be made available to provide any support or guidance that might be required.

My points of contact are COL Keith E. Essen, Deputy Director Army, and Military Health System Office of Transformation and Mr. Clay Boenecke, Chief, Capital Planning Branch, Portfolio Planning and Management Division, TMA. COL Essen can be reached at (202) 762-3098 or keessen@us.med.navy.mil. Mr. Boenecke can be reached at (703) 681-4324 or clayton.boenecke@tma.osd.mil.

William Winkenwerder, Jr., MD

APPENDIX B

TEXAS A&M UNIVERSITY
DIVISION OF RESEARCH AND GRADUATE STUDIES - OFFICE OF RESEARCH COMPLIANCE

1186 TAMU, General Services Complex
College Station, TX 77843-1186
750 Agronomy Road, #3500

979.458.1467
FAX 979.862.3176
http://researchcompliance.tamu.edu

Human Subjects Protection Program — Institutional Review Board

DATE: 02-Nov-2009

MEMORANDUM

TO: MARSH, GLENN EDWARD
77843-3578

FROM: Office of Research Compliance
Institutional Review Board

SUBJECT: Initial Review

Protocol Number: 2009-0770

Title: Examination of Process Issues for Evidence Based Design Implementation on United States Army Medical Construction

Review Category: Exempt from IRB Review

It has been determined that the referenced protocol application meets the criteria for exemption and no further review is required. However, any amendment or modification to the protocol must be reported to the IRB and reviewed before being implemented to ensure the protocol still meets the criteria for exemption.**This determination was based on the following Code of Federal Regulations:** (http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm)

45 CFR 46.101(b)(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior, unless: (a) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (b) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation. **Provisions:**

APPENDIX C

Survey of Evidence-based Design Understanding & Implementation within US Army Medical Construction as administered through online Survey Monkey services.

1. Please mark which Age Group do you belong to:

	Response Percent	Response Count
18-23	0.0%	0
24-33	3.6%	2
34-43	41.1%	23
44-53	33.9%	19
54-63	19.6%	11
64+	1.8%	1
answered question		56
skipped question		0

2. How much experience do you have in the medical construction field (design/construction/outfitting/research)?

	Response Percent	Response Count
0-1 years	1.8%	1
2-5 years	25.0%	14
6-9 years	14.3%	8
10-13 years	19.6%	11
14-17 years	10.7%	6
18-21 years	10.7%	6
22-25 years	8.9%	5
26+ years	8.9%	5
answered question		56
skipped question		0

3. Which of the following best describes your current employment?

	Response Percent	Response Count
US Armed Forces Uniformed Member (Soldier)	42.9%	24
General Schedule (GS)Employee	17.9%	10
Government Contracted Employee	8.9%	5
Architecture Firm	16.1%	9
Construction Firm	0.0%	0
Healthcare Research Firm	0.0%	0
Healthcare Consulting Firm	10.7%	6
Other	3.6%	2
answered question		56
skipped question		0

4. Which the following choices best describes the primary function of your current position:

	Response Percent	Response Count
Policy / Decision Maker	14.3%	8
Administrator	14.3%	8
Funding Acquisition / Budgeting	5.4%	3
Economic Analysis	0.0%	0
Project Developer	3.6%	2
Room Planner / Programmer	0.0%	0
Architectural Designer	8.9%	5
Equipment Outfitter	0.0%	0
Design Reviewer	5.4%	3
Construction Oversight / Manager	0.0%	0
Project Officer	16.1%	9
Health care Consulting	5.4%	3
Transition Planner	0.0%	0
EBD Project Researcher	1.8%	1
Researcher (other than EBD)	0.0%	0
Other	**25.0%**	**14**
	answered question	**56**
	skipped question	**0**

5. What is the highest level of familiarity you have with Evidence Based Design (EBD)?

	Response Percent	Response Count
I am EDAC Certified (Evidence-Based Design Accreditation and Certification)	10.7%	6
I have conducted/participated in formal EBD research	7.1%	4
I have attended formal EBD classes	7.1%	4
I have attended conference lectures on EBD application	46.4%	26
I have read common literature on EBD (Magazines, published articles, etc..)	21.4%	12
I know of EBD, but do not apply details of the process	7.1%	4
I am not familiar with the process	0.0%	0
answered question		56
skipped question		0

6. Based on your personal experience with the medical facility production and operation cycle:

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Very Important	Response Count
1. How important do you feel it is that policy makers be familiar with EBD?	0.0% (0)	0.0% (0)	14.3% (8)	23.2% (13)	62.5% (35)	56
2. How important do you feel it is that facility planners be familiar with EBD?	0.0% (0)	1.8% (1)	1.8% (1)	14.3% (8)	82.1% (46)	56
3. How important do you feel it is that project/construction managers be familiar with EBD?	0.0% (0)	1.8% (1)	12.5% (7)	30.4% (17)	55.4% (31)	56
answered question						56
skipped question						0

7. Have you read and understood the Dr. Winkenwerder's 2007 Health Affairs memo directing the incorporation of the process EBD in military medical facilities?

	Response Percent	Response Count
Yes I have read the directive, and I understand the directive	55.4%	31
Yes I have read the directive, but I do not understand the directive	1.8%	1
Yes I have read the directive, but I do not agree with the directive	1.8%	1
I have not read the directive memo	41.1%	23
answered question		56
skipped question		0

8. Have you read and understood the April 2008 TRICARE Survey on determining what enhancements should be included in health facilities?

	Response Percent	Response Count
Yes I have read the survey results, and I understand the survey results	29.6%	16
Yes I have read the survey results, but I do not understand the survey results	0.0%	0
Yes I have read the survey results, but I do not agree with the survey results	0.0%	0
I have not read the survey results	70.4%	38
answered question		54
skipped question		2

9. Have you read and understood the 19 June, 2009 Tricare Management Activity Department of Defense 1391 Cost Estimating Guidance for Medical Projects?

	Response Percent	Response Count
Yes I have read the guidance document, and I understand the guidance document	22.2%	12
Yes I have read the guidance document, but I do not understand the guidance document	1.9%	1
Yes I have read the guidance document, but I do not agree with the guidance document	5.6%	3
I have not read the guidance document	70.4%	38
answered question		54
skipped question		2

10. Have you read and understood the 2007 EBD in the Military Health System report?

	Response Percent	Response Count
Yes I have read the report, and I understand the report	46.3%	25
Yes I have read the report, but I do not understand the report	0.0%	0
Yes I have read the report, but I do not agree with the report	1.9%	1
I have not read the report	51.9%	28
answered question		54
skipped question		2

11. In your experience, how important are the following choices when applying EBD processes to a military medical construction project?

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Very Important	Response Count
1. Establish clear research goals during the design phase	0.0% (0)	2.0% (1)	13.7% (7)	25.5% (13)	58.8% (30)	51
2. Establish research hypothesis/methodology during the design phase	2.0% (1)	5.9% (3)	17.6% (9)	33.3% (17)	41.2% (21)	51
3. Establish EBD business case and return on investment analaysis	2.0% (1)	0.0% (0)	17.6% (9)	31.4% (16)	49.0% (25)	51
4. Establish EBD based metrics during the design phase	0.0% (0)	0.0% (0)	11.8% (6)	33.3% (17)	54.9% (28)	51
5. Establish EBD based Clinical & Administrative Processes	0.0% (0)	3.9% (2)	9.8% (5)	37.3% (19)	49.0% (25)	51
6. Establish EBD based post-occupancy surveys	0.0% (0)	3.9% (2)	7.8% (4)	29.4% (15)	58.8% (30)	51
7. Having Leadership open to Cultural Transformation	2.0% (1)	0.0% (0)	3.9% (2)	15.7% (8)	78.4% (40)	51
8. Publishing the results of an EBD military medical facility research	2.0% (1)	0.0% (0)	9.8% (5)	37.3% (19)	51.0% (26)	51
					answered question	51
					skipped question	5

12. At what point can EBD principles and processes best be integrated into a military medical facility project?

	Response Percent	Response Count
Pre-design Phase	74.5%	38
Design Phase	23.5%	12
Construction Phase	0.0%	0
Commissioning Phase	2.0%	1
answered question		51
skipped question		5

13. The current cost guidance for adding EBD factors to a military medical facility is:

	Response Percent	Response Count
1-3% of primary facility costs	13.7%	7
3-5% of primary facility costs	23.5%	12
5-7% of primary facility costs	2.0%	1
7-9% of primary facility costs	3.9%	2
9-11% of primary facility costs	7.8%	4
11-13% of primary facility costs	0.0%	0
13-15% of primary facility costs	0.0%	0
I do not know	49.0%	25
answered question		51
skipped question		5

14. In your experience, inclusion of EBD principles/processes should add:

	Response Percent	Response Count
0% to primary facility costs. EBD principles should be included as part of primary square foot facility costs ("good design")	**40.0%**	**20**
1-3% to primary facility costs	14.0%	7
3-5% to primary facility costs	8.0%	4
5-7% to primary facility costs	10.0%	5
7-9% to primary facility costs	0.0%	0
9-11% to primary facility costs	8.0%	4
11-13% to primary facility costs	2.0%	1
13-15% to primary facility costs	0.0%	0
I do not know	18.0%	9
answered question		50
skipped question		6

15. Should EBD certification (such as EDAC certification and research citations) be a requirement for architecture firm personnel to bid on new military medical facility projects?

	Response Percent	Response Count
Yes	54.0%	27
No	30.0%	15
I do not know	16.0%	8
answered question		50
skipped question		6

16. Should EBD certification (such as EDAC certification and research citations) be a requirement for construction firm personnel to bid on new military medical facility projects?

	Response Percent	Response Count
Yes	28.0%	14
No	56.0%	28
I do not know	16.0%	8
answered question		50
skipped question		6

17. Should formal EBD instruction/courses be a requirement for military decision makers / facility planners (uniform and civilian personnel) to have prior to awarding projects with EBD goals?

	Response Percent	Response Count
Yes	88.0%	44
No	10.0%	5
I do not know	2.0%	1
answered question		50
skipped question		6

18. In your experience, should EBD principles and procedures be incorporated/absorbed by the Leadership in Energy and Environmental Design (LEED) process?

	Response Percent	Response Count
Yes	28.0%	14
No	40.0%	20
Not at this time	32.0%	16
answered question		50
skipped question		6

19. In your experience, how important is it for your organization to:

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Very Important	Response Count
1. Conduct EBD research on medical facility projects	2.0% (1)	8.0% (4)	24.0% (12)	26.0% (13)	40.0% (20)	50
2. Allocate resources for an EBD research team on projects	4.0% (2)	16.0% (8)	10.0% (5)	32.0% (16)	38.0% (19)	50
3. Develop and collect realistic metrics before construction	2.0% (1)	2.0% (1)	16.0% (8)	24.0% (12)	56.0% (28)	50
4. Develop and collect realistic metrics during construction	6.0% (3)	10.0% (5)	16.0% (8)	28.0% (14)	40.0% (20)	50
5. Develop and collect realistic metrics post construction	2.0% (1)	2.0% (1)	12.0% (6)	32.0% (16)	52.0% (26)	50
6. Publish project results to the construction community	2.0% (1)	6.0% (3)	14.0% (7)	32.0% (16)	46.0% (23)	50
7. Apply lessons learned to the next project	0.0% (0)	0.0% (0)	4.0% (2)	16.0% (8)	80.0% (40)	50
					answered question	50
					skipped question	6

20. In your experience with your organization, how often are lessons / metrics collected from a previous project actually applied during the design of a follow on project?

	Never	Seldom	Occasionally	Most of the time	Always	Rating Average	Response Count
(Select the choice closest to your organization)	0.0% (0)	30.0% (15)	48.0% (24)	18.0% (9)	4.0% (2)	2.96	50
						answered question	50
						skipped question	6

21. In your experience, rate the importance of the following EBD design goals for medical facilities:

	Not at all Important	Minimally Important	Somewhat Important	Moderately Important	Very Important	Response Count
1. Creation of a Family Centered Environment	0.0% (0)	0.0% (0)	12.2% (6)	34.7% (17)	53.1% (26)	49
2. Improvement of the quality and safety of healthcare delivery (reduce infections, HEPA filtration, reduce stress)	0.0% (0)	0.0% (0)	2.0% (1)	12.2% (6)	85.7% (42)	49
3. Enhancement of patient/family/staff contact with nature and positive distractions	0.0% (0)	0.0% (0)	22.4% (11)	30.6% (15)	46.9% (23)	49
4. Creation of positive work environments through efficiencies, adjacency, lighting/sound/temperature control, and ergonomics	0.0% (0)	0.0% (0)	4.1% (2)	28.6% (14)	67.3% (33)	49
5. Design exhibits coherent standardization and flexibility	0.0% (0)	0.0% (0)	10.2% (5)	38.8% (19)	51.0% (25)	49
					answered question	49
					skipped question	7

22. In your experience, how well were the following design goals achieved in the 2007 Bassett Army Community Hospital design?

	Did not achieve goal	Partially achieved goal	Achieved goal	I do not know	Response Count
1. Creation of a Family Centered Environment	0.0% (0)	18.4% (9)	14.3% (7)	67.3% (33)	49
2. Improvement of the quality and safety of healthcare delivery (reduce infections, HEPA filtration, reduce stress)	0.0% (0)	10.2% (5)	18.4% (9)	71.4% (35)	49
3. Enhancement of patient/family/staff contact with nature and positive distractions	6.1% (3)	10.2% (5)	22.4% (11)	61.2% (30)	49
4. Creation of positive work environments through efficiencies, adjacency, lighting/sound/temperature control, and ergonomics	2.0% (1)	14.3% (7)	20.4% (10)	63.3% (31)	49
5. Design exhibits coherent standardization and flexibility	4.1% (2)	18.4% (9)	8.2% (4)	69.4% (34)	49
				answered question	49
				skipped question	7

23. In your experience, how well were the following design goals achieved in the new Walter Reed National Military Medical Center design?

	Did not achieve goal	Partially achieved goal	Achieved goal	I do not know	Response Count
1. Creation of a Family Centered Environment	6.1% (3)	14.3% (7)	4.1% (2)	75.5% (37)	49
2. Improvement of the quality and safety of healthcare delivery (reduce infections, HEPA filtration, reduce stress)	0.0% (0)	20.4% (10)	4.1% (2)	75.5% (37)	49
3. Enhancement of patient/family/staff contact with nature and positive distractions	10.2% (5)	14.3% (7)	2.0% (1)	73.5% (36)	49
4. Creation of positive work environments through efficiencies, adjacency, lighting/sound/temperature control, and ergonomics	4.1% (2)	18.4% (9)	4.1% (2)	73.5% (36)	49
5. Design exhibits coherent standardization and flexibility	8.2% (4)	14.3% (7)	2.0% (1)	75.5% (37)	49
				answered question	49
				skipped question	7

24. In your experience, how well were the following design goals achieved in the new Fort Belvoir Army Community Hospital design?

	Did not achieve goal	Partially achieved goal	Achieved goal	I do not know	Response Count
1. Creation of a Family Centered Environment	0.0% (0)	8.2% (4)	51.0% (25)	40.8% (20)	49
2. Improvement of the quality and safety of healthcare delivery (reduce infections, HEPA filtration, reduce stress)	0.0% (0)	10.2% (5)	42.9% (21)	46.9% (23)	49
3. Enhancement of patient/family/staff contact with nature and positive distractions	0.0% (0)	6.1% (3)	53.1% (26)	40.8% (20)	49
4. Creation of positive work environments through efficiencies, adjacency, lighting/sound/temperature control, and ergonomics	0.0% (0)	10.2% (5)	51.0% (25)	38.8% (19)	49
5. Design exhibits coherent standardization and flexibility	2.0% (1)	16.3% (8)	42.9% (21)	38.8% (19)	49
				answered question	49
				skipped question	7

25. In your experience, how well were the following design goals achieved in the new Fort Riley Army Community Hospital design?

	Did not achieve goal	Partially achieved goal	Achieved goal	I do not know	Response Count
1. Creation of a Family Centered Environment	0.0% (0)	10.2% (5)	12.2% (6)	77.6% (38)	49
2. Improvement of the quality and safety of healthcare delivery (reduce infections, HEPA filtration, reduce stress)	0.0% (0)	8.2% (4)	8.2% (4)	83.7% (41)	49
3. Enhancement of patient/family/staff contact with nature and positive distractions	2.0% (1)	6.1% (3)	14.3% (7)	77.6% (38)	49
4. Creation of positive work environments through efficiencies, adjacency, lighting/sound/temperature control, and ergonomics	0.0% (0)	8.2% (4)	12.2% (6)	79.6% (39)	49
5. Design exhibits coherent standardization and flexibility	0.0% (0)	10.2% (5)	12.2% (6)	77.6% (38)	49
				answered question	49
				skipped question	7

26. How many EBD medical projects (military and civilian) in your experience do you feel are necessary to validate specific EBD interventions (such as single patient room layouts) prior to inclusion in guide plates and other official prescriptive federal documents?

	Response Percent	Response Count
0	4.1%	2
1-3	34.7%	17
4-6	42.9%	21
7-9	2.0%	1
10+	16.3%	8
answered question		49
skipped question		7

27. Does your organization dedicate in-house resources (funding, FTE researchers, etc...) to conduct EBD research in accordance with the procedures outlined in the Center for Health Design?

	Response Percent	Response Count
Yes	30.6%	15
No	42.9%	21
I do not know	26.5%	13
answered question		49
skipped question		7

28. In your experience, how effective is an EBD based return on investment strategy in saving taxpayers money?

	Response Percent	Response Count
Not at all Effective	2.1%	1
Minimally Effective	27.7%	13
Somewhat Effective	27.7%	13
Moderately Effective	25.5%	12
Very Effective	17.0%	8
answered question		47
skipped question		9

29. How many case studies of EBD projects have you personally studied (completed or under construction) to learn about benefits/problems of EBD features in relation to real-world examples?

	Response Percent	Response Count
0	34.7%	17
1-2	26.5%	13
3-4	16.3%	8
5-7	8.2%	4
8-10	0.0%	0
11-13	6.1%	3
14+	8.2%	4
answered question		49
skipped question		7

30. With the attention that the term Evidence Based Design has gotten from the federal government, it runs the real risk of becoming a marketing buzz-phrase. In your experience, does your organization conduct serious research based design interventions or simply label a "good design" with EBD to better market the organization?

	Response Percent	Response Count
My organization conducts EBD interventions with serious research rigor	36.7%	18
My organization uses EBD mainly for marketing	22.4%	11
I do not know	40.8%	20
answered question		49
skipped question		7

APPENDIX D

Military Hospital Review by Military Health System Evidence-based Design Principles, Interventions, and Outcomes Matrix (Casscells, Kurmel, Ponatoski, 2009).

EBD Principle I	Create a Patient and Family Centered Environment	Present at Bassett Army Community Hospital?
Increased Social Support	Family zone in Patient Room	No, room size per SEPSII guide plate. Sleeper chair present in rooms.
	Family Respite	Yes
	Waiting rooms and lounges with comfortable and movable furniture arranged In small flexible groupings	Partial, furniture schedule includes both fixed and separate seating
	Provide a variety of seating to accommodate widest range of persons	Partial
	Strive for residential, not institutional look	Yes
Reduce Spatial Disorientation	Carefully consider external building cues	Yes
	Provide visible and easily understood signage (i.e. approach)	Partial, signage inconsistent.
	Use common language in signs with local room numbering	Partial, signage inconsistent.
	Provide directional signs before or at any major intersection	Partial, signage inconsistent.
	Provide here-you-are maps oriented with the top signifying direction of movement	Partial, signage inconsistent.
Provide adequate and appropriate light exposure	Provide large windows for access to natural daylight inpatient rooms, along with provisions for controlling glare and temperature	Yes, windows oriented for sunlight & contain glare/temperature controls
	Maximize use of natural light	Yes
	Orient patient rooms to maximize early morning sun exposure and natural light	Yes for inpatient rooms. Partial for gournd floor clinic spaces.
	Provide high lighting levels for complex visual tasks	Partial, reflected ceiling plans and light specifications sheet did not cover all charting
	Provide windows in staff break rooms when possible	Partial, used where available.
Support optimal patient nutrition	Provide a design that encourages family participation in patient nutrition	No
	Provide convenient food facilities	Yes, central dining facilities support inpatient/outpatient locations and patient rooms
Improve patient sleep and rest	Single patient rooms	Yes
	Noise Control (see EBD feature#2 for features to reduce noise stress)	Partial, no active noise control systems but efforts made to reduce overall noise by design
	Comfortable beds and bedding	Yes. No issues during P.O.E.
	Maximize exposure to daylight	Yes, design specifically meant to capture Alaskan seasonal sunlight
Increase Patient privacy and confidentiality	Single patient rooms	Yes
	Rooms enclosed with walls in areas where patients would expect to disclose confidential information	Yes, outpatient areas show counseling rooms for private consultations that are HIPPA compliant
	Use high performance sound-absorbing ceiling tiles	No
	Avoid physical proximity between staff and visitors	Partial, only treatment areas/surgical wards displayed seperation of patient/visiter paths
Decrease exposure to harmful chemicals	Use 100% lead and cadmium-free roofing, wiring, and paint	No
	Install low-mercury florescent lamps	No
	Use low-emitting VOC and PFC materials	No
	Use materials with no PBDE or phthalates	No
	Minimize use of furniture that contain no more than one: PBDE, PFA, urea-formaldehyde, phthalate, and plasticizers	No
EBD Principle II	**Improve the Quality and Safety of Healthcare Delivery**	
Reduce airborne transmitted infections	Single patient rooms	Yes
	Maximize HEPA (99.97%) filtration for appropriate hospital areas	Partial. Unreconciled security compliance vs. dirty bomb scenario
	Well maintained and operated ventilation systems	Yes
	Effective control measure during construction	Yes. COE and USAPHFPA project officers onsite through construction (PRE-EBD Design)
	Windows that open	No. Outside temperatures can reach -20 Degrees
Reduce infection spread through contact	Single patient rooms easier to decontaminate	Yes
	Support hand washing with conveniently placed sinks, hand-washing liquid dispensers, and alcohol rubs	Partial
	Careful selection of materials with cleanability a key consideration	Yes
	Frequent cleaning of high-contact surfaces	Yes
Prevent waterborne infections	Regular maintenance and inspection of water supply system to minimize stagnation and back flow and for temperature control	Yes
	Use proper water treatment	Yes
	Regularly clean and maintain faucet aerators to prevent and control for Legionella	Yes
	Avoid decorative water fountains in high-risk patient areas	Yes
	Fountain water temperature should be kept cold, and fountains should be regularly cleaned and maintained	Yes
Reduce medication errors	Assess adequacy of lighting level in staff work areas	Yes, also include binaural lighting designs
	Provide high lighting levels for complex visual tasks (1,500 lux)	Partial, HKS lighting specifications inconsistent
	Provide space for private work	Partial, floor function dependent.
Reduce room transfers	Provide acuity-adaptable rooms	Partial
	Provide larger patient zone to support more in-room procedures	Yes, larger than space planning equipment program (SEPS II) criteria
Prevent patient falls	Single patient rooms	Yes
	Decentralized support in pods	Partial
	Bed alarms	Yes
	Assistive devices (e.g., headwall rails, larger bathroom doors, bathroom location)	Partial, ICU rooms contain inconsistencies in standardization.
Reduce noise stress and improve speech intelligibility	Single-patient rooms	Yes
	Install high-performance sound absorbing acoustical ceiling tiles	No
	Remove or reduce loud noise sources through use of noiseless paging and alarm systems, equipment placement, etc.	No
	Provide patient examination rooms and treatment areas with walls that extend fully to the support ceiling	Yes
	Use carpet and rubber floors where appropriate	Yes
EBD Principle III	**Support care of whole person, enhanced by contact with nature and positive distractions**	
	Provide secure access to nature (i.e. central green zones)	Partial. Garden zones located, but appears restricted to outpatient, family and staff use.
	Provide positive distractions (i.e. art, music, etc.)	Partial, art specifically designed using Alaskan landscape as inspiration. Not verified with biophilia checklists.
	Provide multiple spiritual spaces and haven areas	Partial. Chapel identified along with private counseling rooms. Military chapels are multi-
	Explore Fisher-house-like support and child care options	No
	Establish a Patient and Family Design Review Committee	Partial, imput from patients and families accepted but not formalized in committee.
EBD Principle IV	**Create a positive Work Environment**	
Decrease back pain and work related injuries	Install ceiling mounted lifts	No. Use of mobile lift systems being considered.
	Use softer floors	No
	Ergonomically evaluate work areas	Partial. Military uses contractors such as Herman Miller for furniture for some hospital areas that meet ergonomic specifications.
	Provide on-site staff exercise facilities	No.
Reduce staff fatigue and increase time with patients	Decentralize staff support spaces (i.e. charting, supplies, medications) proximate to patient rooms (pod configuration) to minimize staff walking and increase time with patients	Yes.
	Provide windows in staff break rooms so staff has access to natural light	Partial, used where available.
Increase healthcare team effectiveness through improved communication	Provide different types of space for interactive team work	Partial
	Flexible work spaces	Partial, post-occupancy review issue. No metrics currently in place to measure during P.O.E.
	Visual connections to facilitate information seeking and interaction	Yes, specific use of commissioned are for wayfinding
Eliminate noisy, chaotic environments	See EBD principle #2, reduce noise and consider work flows in relation to key spaces	No
	Provide adequate space for private work to minimize distractions and interruptions	Partial, office space for administrative personnel present
	Provide a visual connection to patients	Partial, room design outside of bed towers no consistent.
EBD Principle V	**Design for Maximum Standardization and future flexibility and growth**	
Facilitate care coordination and patient service	Collate related services into Care Centers (i.e. musculoskeletal, cancer)	Yes
	Flexible work spaces to encourage multidisciplinary use	Yes
Expand public space utility	Create flexible public spaces to support multiple missions (i.e. MASCAL, health fairs)	Partial - Military facilities are required to have MASCAL procedures in place.

EBD Principle I	Create a Patient and Family Centered Environment	Present at FT Belvoir Dewitt Army Community Hospital?
Increased Social Support	Family zone in Patient Room	Yes
	Family Respite	Yes
	Waiting rooms and lounges with comfortable and movable furniture arranged In small flexible groupings	Partial, furniture schedule includes both fixed and separate seating
	Provide a variety of seating to accommodate widest range of persons	Partial
	Strive for residential, not institutional look	Partial, undefined residential vs. institutional, no citations noted to support choices
Reduce Spatial Disorientation	Carefully consider external building cues	Yes
	Provide visible and easily understood signage (i.e. approach)	Unknown, HDR signage package not listed at FTP site
	Use common language in signs with local room numbering	Unknown, HDR signage package not listed at FTP site
	Provide directional signs before or at any major intersection	Unknown, HDR signage package not listed at FTP site
	Provide here-you-are maps oriented with the top signifying direction of movement	Unknown, HDR signage package not listed at FTP site
Provide adequate and appropriate light exposure	Provide large windows for access to natural daylight inpatient rooms, along with provisions for controlling glare and temperature	Partial, windows present and oriented but slacking pecifications for glare/temperature controls
	Maximize use of natural light	Yes
	Orient patient rooms to maximize early morning sun exposure and natural light	Yes for inpatient rooms. No for gournd floor clinic spaces.
	Provide high lighting levels for complex visual tasks	Partial, reflected ceiling plans and light specifications sheet did not cover all charting locations.
	Provide windows in staff break rooms when possible	Partial, check total numbers proximity to exterior windows from HDR plans
Support optimal patient nutrition	Provide a design that encourages family participation in patient nutrition	Partial, design contains family space but no indications of meal preparation / serving
	Provide convenient food facilities	Yes, central dining facilities support inpatient/outpatient locations and patient rooms
Improve patient sleep and rest	Single patient rooms	Yes
	Noise Control (see EBD feature#2 for features to reduce noise stress)	HDR compiled all noise measures under EBD Principle #2
	Comfortable beds and bedding	Unknown, beds meet current patient specifications. How is "comfortable" clinically defined?
	Maximize exposure to daylight	Unknown, check HDR sun and light studies
Increase Patient privacy and confidentiality	Single patient rooms	Yes
	Rooms enclosed with walls in areas where patients would expect to disclose confidential information	Yes, outpatient areas show counseling rooms for private consultations that are HIPPA compliant
	Use high performance sound-absorbing ceiling tiles	Partial, inconsistent use in HDR specifications. What maintenance replacement issues identified?
	Avoid physical proximity between staff and visitors	Partial, only treatment areas/surgical wards displayed seperation of patient/visiter paths
Decrease exposure to harmful chemicals	Use 100% lead and cadmium-free roofing, wiring, and paint	Unknown, Cannot confirm HDR specifications versus onsite installation (Dave Fortune contact)
	Install low-mercury florescent lamps	Unknown, Cannot confirm HDR specifications versus onsite installation (Dave Fortune contact)
	Use low-emitting VOC and PFC materials	Unknown, Cannot confirm HDR specifications versus onsite installation (Dave Fortune contact)
	Use materials with no PBDE or phthalates	Unknown, Cannot confirm HDR specifications versus onsite installation (Dave Fortune contact)
	Minimize use of furniture that contain no more than one: PBDE, PFA, urea-formaldehyde, phthalate, and plasticizers	Unknown, Cannot confirm HDR specifications versus onsite installation (Dave Fortune contact)
EBD Principle II	**Improve the Quality and Safety of Healthcare Delivery**	
Reduce airborne transmitted infections	Single patient rooms	Yes
	Maximize HEPA (99.97%) filtration for appropriate hospital areas	Yes. Unreconciled security compliance vs. dirty bomb scenario
	Well maintained and operated ventilation systems	Unknown, post-occupancy issue. No metrics currently in place to measure during P.O.E. Survey.
	Effective control measure during construction	Partial, Project officers onsite, but report few inspections by COE Center for Medical Excellence
	Windows that open	Partial, restricted window areas versus proximity to patient/family/staff use locations
Reduce infection spread through contact	Single patient rooms easier to decontaminate	Yes
	Support hand washing with conveniently placed sinks, hand-washing liquid dispensers, and alcohol rubs	Yes
	Careful selection of materials with cleanability a key consideration	Yes
	Frequent cleaning of high-contact surfaces	Unknown, post-occupancy issue. No metrics currently in place to measure during P.O.E. Survey.
Prevent waterborne infections	Regular maintenance and inspection of water supply system to minimize stagnation and back flow and for temperature control	Unknown, post-occupancy issue. No metrics currently in place to measure during P.O.E. Survey.
	Use proper water treatment	Unknown, post-occupancy issue. No metrics currently in place to measure during P.O.E. Survey.
	Regularly clean and maintain faucet aerators to prevent and control for Legionella	Unknown, post-occupancy issue. No metrics currently in place to measure during P.O.E. Survey.
	Avoid decorative water fountains in high-risk patient areas	Yes
	Fountain water temperature should be kept cold, and fountains should be regularly cleaned and maintained	Unknown, post-occupancy issue. No metrics currently in place to measure during P.O.E. Survey.
Reduce medication errors	Assess adequacy of lighting level in staff work areas	Unknown, post-occupancy issue. No metrics currently in place to measure during P.O.E. Survey.
	Provide high lighting levels for complex visual tasks (1,500 lux)	Partial, HDR lighting specifications inconsistent
	Provide space for private work	Partial, floor function dependent.
Reduce room transfers	Provide acuity-adaptable rooms	Unknown, check with HDR concept of operations. Are connections present on plans to support MA-Rooms?
	Provide larger patient zone to support more in-room procedures	Yes, larger than space planning equipment program (SEPS II) criteria
Prevent patient falls	Single patient rooms	Yes
	Decentralized support in pods	Partial
	Bed alarms	Yes
	Assistive devices (e.g., headwall rails, larger bathroom doors, bathroom location)	Partial, ICU rooms contain inconsistencies in standardization.
Reduce noise stress and improve speech intelligibility	Single-patient rooms	Yes
	Install high-performance sound absorbing acoustical ceiling tiles	Unknown, HDR specifications inconsistent
	Remove or reduce loud noise sources through use of noiseless paging and alarm systems, equipment placement, etc.	Unknown, post-occupancy issue. No metrics currently in place to measure during P.O.E. Survey.
	Provide patient examination rooms and treatment areas with walls that extend fully to the support ceiling	Yes
	Use carpet and rubber floors where appropriate	Yes
EBD Principle III	**Support care of whole person, enhanced by contact with nature and positive distractions**	
	Provide secure access to nature (i.e. central green zones)	Partial. Garden zones located, but appears restricted to outpatient, family and staff use.
	Provide positive distractions (i.e. art, music, etc.)	Unknown, post-occupancy issue. No metrics currently in place to measure during P.O.E. Survey.
	Provide multiple spiritual spaces and haven areas	Partial. Chapel identified along with private counseling rooms. Military chapels are multi-denomination.
	Explore Fisher-house-like support and child care options	Unknown, child care not yet located on plans.
	Establish a Patient and Family Design Review Committee	Unknown, post-occupancy issue. No metrics currently in place to measure during P.O.E. Survey.
EBD Principle IV	**Create a positive Work Environment**	
Decrease back pain and work related injuries	Install ceiling mounted lifts	No. Use of mobile lift systems being considered.
	Use softer floors	No
	Ergonomically evaluate work areas	Partial. Military uses contractors such as Herman Miller for furniture for some hospital areas that meet ergonomic specifications.
	Provide on-site staff exercise facilities	No. Gym not present in plans
Reduce staff fatigue and increase time with patients	Decentralize staff support spaces (i.e. charting, supplies, medications) proximate to patient rooms (pod configuration) to minimize staff walking and increase time with patients	Yes.
	Provide windows in staff break rooms so staff has access to natural light	Partial, check plans for total numbers with/without natural light and orientation versus sun/light study
Increase healthcare team effectiveness through improved communication	Provide different types of space for interactive team work	Partial
	Flexible work spaces	Partial, post-occupancy review issue. No metrics currently in place to measure during P.O.E. Survey.
	Visual connections to facilitate information seeking and interaction	Unknown, post-occupancy issue. No metrics currently in place to measure during P.O.E. Survey.
Eliminate noisy, chaotic environments	See EBD principle #2, reduce noise and consider work flows in relation to key spaces	Unknown, HDR specifications for maximum noise levels not listed in reference material.
	Provide adequate space for private work to minimize distractions and interruptions	Partial, office space for administrative personnel present
	Provide a visual connection to patients	Partial, room design outside of bed towers no consistent.
EBD Principle V	**Design for Maximum Standardization and future flexibility and growth**	
Facilitate care coordination and patient service	Collate related services into Care Centers (i.e. musculoskeletal, cancer)	Yes
	Flexible work spaces to encourage multidisciplinary use	Yes
Expand public space utility	Create flexible public spaces to support multiple missions (i.e. MASCAL, health fairs)	Partial - Military facilities are required to have MASCAL procedures in place.

EBD Principle I	Create a Patient and Family Centered Environment	Present at Walter Reed National Military Medical Center?
Increased Social Support	Family zone in Patient Room	No, room size per SEPSII guide plate. Sleeper chair present in rooms.
	Family Respite	Yes
	Waiting rooms and lounges with comfortable and movable furniture arranged In small flexible groupings	Partial, legacy furniture schedule includes both fixed and separate seating
	Provide a variety of seating to accommodate widest range of persons	Partial
	Strive for residential, not institutional look	No
Reduce Spatial Disorientation	Carefully consider external building cues	Yes
	Provide visible and easily understood signage (i.e. approach)	Partial, signage inconsistent.
	Use common language in signs with local room numbering	Partial, signage inconsistent.
	Provide directional signs before or at any major intersection	Partial, signage inconsistent.
	Provide here-you-are maps oriented with the top signifying direction of movement	Partial, signage inconsistent.
Provide adequate and appropriate light exposure	Provide large windows for access to natural daylight inpatient rooms, along with provisions for controlling glare and temperature	No
	Maximize use of natural light	Yes
	Orient patient rooms to maximize early morning sun exposure and natural light	Partial
	Provide high lighting levels for complex visual tasks	Partial, reflected ceiling plans and light specifications sheet did not cover all charting locations.
	Provide windows in staff break rooms when possible	Partial, used where available.
Support optimal patient nutrition	Provide a design that encourages family participation in patient nutrition	No
	Provide convenient food facilities	No
Improve patient sleep and rest	Single patient rooms	Yes
	Noise Control (see EBD feature#2 for features to reduce noise stress)	No
	Comfortable beds and bedding	Yes. No issues during P.O.E.
	Maximize exposure to daylight	No
Increase Patient privacy and confidentiality	Single patient rooms	Yes
	Rooms enclosed with walls in areas where patients would expect to disclose confidential information	Yes, outpatient areas show counseling rooms for private consultations that are HIPPA compliant
	Use high performance sound-absorbing ceiling tiles	No
	Avoid physical proximity between staff and visitors	No
Decrease exposure to harmful chemicals	Use 100% lead and cadmium-free roofing, wiring, and paint	No
	Install low-mercury florescent lamps	No
	Use low-emitting VOC and PFC materials	No
	Use materials with no PBDE or phthalates	No
	Minimize use of furniture that contain no more than one: PBDE, PFA, urea-formaldehyde, phthalate, and plasticizers	No
EBD Principle II	**Improve the Quality and Safety of Healthcare Delivery**	
Reduce airborne transmitted infections	Single patient rooms	Partial
	Maximize HEPA (99.97%) filtration for appropriate hospital areas	Partial. Unreconciled security compliance vs. dirty bomb scenario
	Well maintained and operated ventilation systems	Yes
	Effective control measure during construction	Partial. Mixed oversight of Joint Service personnel.
	Windows that open	No
Reduce infection spread through contact	Single patient rooms easier to decontaminate	Partial, legacy room designs creates cleaning issues
	Support hand washing with conveniently placed sinks, hand-washing liquid dispensers, and alcohol rubs	Partial
	Careful selection of materials with cleanability a key consideration	Partial, legacy materials in place no compliant with modern finish specifications
	Frequent cleaning of high-contact surfaces	Yes
Prevent waterborne infections	Regular maintenance and inspection of water supply system to minimize stagnation and back flow and for temperature control	Yes
	Use proper water treatment	Yes
	Regularly clean and maintain faucet aerators to prevent and control for Legionella	Yes
	Avoid decorative water fountains in high-risk patient areas	Yes
	Fountain water temperature should be kept cold, and fountains should be regularly cleaned and maintained	Yes
Reduce medication errors	Assess adequacy of lighting level in staff work areas	Partial, renovated areas not always consistent
	Provide high lighting levels for complex visual tasks (1,500 lux)	Partial, implementation inconsistent
	Provide space for private work	Partial, floor function dependent.
Reduce room transfers	Provide acuity-adaptable rooms	Partial
	Provide larger patient zone to support more in-room procedures	Partial, larger than space planning equipment program (SEPS II) criteria
Prevent patient falls	Single patient rooms	Yes
	Decentralized support in pods	Partial
	Bed alarms	Yes
	Assistive devices (e.g., headwall rails, larger bathroom doors, bathroom location)	Partial, ICU rooms contain inconsistencies in standardization.
Reduce noise stress and improve speech intelligibility	Single-patient rooms	Yes
	Install high-performance sound absorbing acoustical ceiling tiles	No
	Remove or reduce loud noise sources through use of noiseless paging and alarm systems, equipment placement, etc.	No
	Provide patient examination rooms and treatment areas with walls that extend fully to the support ceiling	Yes
	Use carpet and rubber floors where appropriate	Yes
EBD Principle III	**Support care of whole person, enhanced by contact with nature and positive distractions**	
	Provide secure access to nature (i.e. central green zones)	No. Legacy areas marginally considered partial dependent on floor function.
	Provide positive distractions (i.e. art, music, etc.)	Partial, art specifically designed using Alaskan landscape as inspiration. Not verified with biophilia checklists.
	Provide multiple spiritual spaces and haven areas	Partial. Chapel identified along with private counseling rooms. Military chapels are multi-denomination.
	Explore Fisher-house-like support and child care options	No
	Establish a Patient and Family Design Review Committee	Partial, imput from patients and families accepted but not formalized in committee.
EBD Principle IV	**Create a positive Work Environment**	
Decrease back pain and work related injuries	Install ceiling mounted lifts	No. Use of mobile lift systems being considered.
	Use softer floors	No
	Ergonomically evaluate work areas	Partial. Military uses contractors such as Herman Miller for furniture for some hospital areas that meet ergonomic specifications.
	Provide on-site staff exercise facilities	No.
Reduce staff fatigue and increase time with patients	Decentralize staff support spaces (i.e. charting, supplies, medications) proximate to patient rooms (pod configuration) to minimize staff walking and increase time with patients	Yes.
	Provide windows in staff break rooms so staff has access to natural light	Partial, used where available.
Increase healthcare team effectiveness through improved communication	Provide different types of space for interactive team work	Partial
	Flexible work spaces	Partial, post-occupancy review issue. No metrics currently in place to measure during P.O.E. Survey.
	Visual connections to facilitate information seeking and interaction	Yes, specific use of commissioned are for wayfinding
Eliminate noisy, chaotic environments	See EBD principle #2, reduce noise and consider work flows in relation to key spaces	No
	Provide adequate space for private work to minimize distractions and interruptions	Partial, office space for administrative personnel present
	Provide a visual connection to patients	Partial, room design outside of bed towers no consistent.
EBD Principle V	**Design for Maximum Standardization and future flexibility and growth**	
Facilitate care coordination and patient service	Collate related services into Care Centers (i.e. musculoskeletal, cancer)	Yes
	Flexible work spaces to encourage multidisciplinary use	Yes
Expand public space utility	Create flexible public spaces to support multiple missions (i.e. MASCAL, health fairs)	Partial - Military facilities are required to have MASCAL procedures in place.

EBD Principle I	Create a Patient and Family Centered Environment	Present at Fort Riley Army Community Hospital?
Increased Social Support	Family zone in Patient Room	Partial, concept design calls for familiy zone not specified in SEPS II guide plates
	Family Respite	Yes
	Waiting rooms and lounges with comfortable and movable furniture arranged In small flexible groupings	Unknown, furnishings not ordered
	Provide a variety of seating to accommodate widest range of persons	Partial based on current concepts
	Strive for residential, not institutional look	Yes
Reduce Spatial Disorientation	Carefully consider external building cues	Yes, design concept complete
	Provide visible and easily understood signage (i.e. approach)	Unknown, signage package not finalized
	Use common language in signs with local room numbering	Unknown, signage package not finalized
	Provide directional signs before or at any major intersection	Unknown, signage package not finalized
	Provide here-you-are maps oriented with the top signifying direction of movement	Unknown, signage package not finalized
Provide adequate and appropriate light exposure	Provide large windows for access to natural daylight inpatient rooms, along with provisions for controlling glare and temperature	Yes
	Maximize use of natural light	Yes, LEED Silver design expectation
	Orient patient rooms to maximize early morning sun exposure and natural light	Yes, LEED Silver design expectation
	Provide high lighting levels for complex visual tasks	Yes, LEED Silver design expectation
	Provide windows in staff break rooms when possible	Yes, LEED Silver design expectation
Support optimal patient nutrition	Provide a design that encourages family participation in patient nutrition	Partial, design under review
	Provide convenient food facilities	Yes
Improve patient sleep and rest	Single patient rooms	Yes
	Noise Control (see EBD feature#2 for features to reduce noise stress)	Yes
	Comfortable beds and bedding	Yes. Pending P.O.E. review.
	Maximize exposure to daylight	Yes, LEED Silver design expectation
Increase Patient privacy and confidentiality	Single patient rooms	Yes
	Rooms enclosed with walls in areas where patients would expect to disclose confidential information	Yes, outpatient areas show counseling rooms for private consultations that are HIPPA compliant
	Use high performance sound-absorbing ceiling tiles	No
	Avoid physical proximity between staff and visitors	No
Decrease exposure to harmful chemicals	Use 100% lead and cadmium-free roofing, wiring, and paint	Yes, LEED Silver design expectation
	Install low-mercury florescent lamps	Yes, LEED Silver design expectation
	Use low-emitting VOC and PFC materials	Yes, LEED Silver design expectation
	Use materials with no PBDE or phthalates	Yes, LEED Silver design expectation
	Minimize use of furniture that contain no more than one: PBDE, PFA, urea-formaldehyde, phthalate, and plasticizers	Yes, LEED Silver design expectation
EBD Principle II	**Improve the Quality and Safety of Healthcare Delivery**	
Reduce airborne transmitted infections	Single patient rooms	Yes
	Maximize HEPA (99.97%) filtration for appropriate hospital areas	Yes, LEED Silver design expectation
	Well maintained and operated ventilation systems	Yes, LEED Silver design expectation
	Effective control measure during construction	Yes, LEED Silver design expectation
	Windows that open	Partial
Reduce infection spread through contact	Single patient rooms easier to decontaminate	Yes
	Support hand washing with conveniently placed sinks, hand-washing liquid dispensers, and alcohol rubs	Yes
	Careful selection of materials with cleanability a key consideration	Yes
	Frequent cleaning of high-contact surfaces	Yes, pending P.O.E. review
Prevent waterborne infections	Regular maintenance and inspection of water supply system to minimize stagnation and back flow and for temperature control	Yes, LEED Silver design expectation
	Use proper water treatment	Yes, LEED Silver design expectation
	Regularly clean and maintain faucet aerators to prevent and control for Legionella	Yes
	Avoid decorative water fountains in high-risk patient areas	Yes
	Fountain water temperature should be kept cold, and fountains should be regularly cleaned and maintained	Yes
Reduce medication errors	Assess adequacy of lighting level in staff work areas	Yes
	Provide high lighting levels for complex visual tasks (1,500 lux)	Yes
	Provide space for private work	Partial, floor function dependent.
Reduce room transfers	Provide acuity-adaptable rooms	Partial
	Provide larger patient zone to support more in-room procedures	Partial, larger than space planning equipment program (SEPS II) criteria
Prevent patient falls	Single patient rooms	Yes
	Decentralized support in pods	Partial, pending final design S7 submissions.
	Bed alarms	Yes
	Assistive devices (e.g., headwall rails, larger bathroom doors, bathroom location)	Yes
Reduce noise stress and improve speech intelligibility	Single-patient rooms	Yes
	Install high-performance sound absorbing acoustical ceiling tiles	Partial, floor function dependent.
	Remove or reduce loud noise sources through use of noiseless paging and alarm systems, equipment placement, etc.	Partial, floor function dependent.
	Provide patient examination rooms and treatment areas with walls that extend fully to the support ceiling	Yes
	Use carpet and rubber floors where appropriate	Yes
EBD Principle III	**Support care of whole person, enhanced by contact with nature and positive distractions**	
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	Provide multiple spiritual spaces and haven areas	Partial. Chapel identified along with private counseling rooms. Military chapels are multi-denomination.
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	Establish a Patient and Family Design Review Committee	Partial, imput from patients and families accepted but not formalized in committee.
EBD Principle IV	**Create a positive Work Environment**	
Decrease back pain and work related injuries	Install ceiling mounted lifts	Yes
	Use softer floors	Partial, pending final design S7 submissions.
	Ergonomically evaluate work areas	Partial. Military uses contractors such as Herman Miller for furniture for some hospital areas that meet ergonomic
	Provide on-site staff exercise facilities	Partial, pending final design S7 submissions.
Reduce staff fatigue and increase time with patients	Decentralize staff support spaces (i.e. charting, supplies, medications) proximate to patient rooms (pod configuration) to minimize staff walking and increase time with patients	Yes.
	Provide windows in staff break rooms so staff has access to natural light	Partial, used where available.
Increase healthcare team effectiveness through improved communication	Provide different types of space for interactive team work	Partial
	Flexible work spaces	Yes
	Visual connections to facilitate information seeking and interaction	Yes, specific use of commissioned are for wayfinding
Eliminate noisy, chaotic environments	See EBD principle #2, reduce noise and consider work flows in relation to key spaces	Partial, where applicable
	Provide adequate space for private work to minimize distractions and interruptions	Partial, office space for administrative personnel present
	Provide a visual connection to patients	Partial, room design outside of bed towers no consistent.
EBD Principle V	**Design for Maximum Standardization and future flexibility and growth**	
Facilitate care coordination and patient service	Collate related services into Care Centers (i.e. musculoskeletal, cancer)	Yes
	Flexible work spaces to encourage multidisciplinary use	Yes
Expand public space utility	Create flexible public spaces to support multiple missions (i.e. MASCAL, health fairs)	Partial - Military facilities are required to have MASCAL procedures in place.

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